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Cracking of Cement Grouted Brick Pavements*

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THE first essential to be recognized in the study of the cause of the failure of cement filled, or "grouted," brick or block pavements by cracking of the paved surface, is that these failures are due not to a single cause, but to several distinct and widely differing causes. A fairly careful investigation of available literature on brick pavement construction has failed to bring to the writer's attention any competent analysis of these various causes of failure and the corresponding remedies.

The following are causes of cracks in brick or block pavements which the writer has observed; and they are placed, he believes, in the order of their importance and frequency of occurrence, and will be discussed separately in that order:

1. Frost.
2. Expansion.
3. Settling of sand cushion.
4. Settling of sub-grade.
5. Contraction between transverse expansion joints.

1. *Frost.* The writer's observations seem to him to prove beyond doubt that the longitudinal crack along the crown of the pavement (or sometimes several feet to one side of the crown) is nearly always, if not always, caused by frost. This is the cause which the average layman usually assigns, and perhaps that is the reason that the average engineer, in his assumption of wisdom, is convinced that it is the wrong solution. The following observations support the layman's theory:

(a) These longitudinal cracks invariably first appear in the form of a very small and insignificant appearing crack, when the snow goes off in the spring.

(b) Where the sub-soil is clay, the cracks are found where ample expansion joints are provided next the curb, as well as where there are no expansion joints.

(c) Where the sub-soil is sand, or on fills where there is good natural drainage, these cracks are "conspicuous by their absence," even where there are no expansion cushions.

(d) The cracks follow along the line of travel on the street usually along near the crown, where the snow is packed by traffic during the winter and the frost penetrates deepest. Where there are one or more car-tracks on the street, there is usually a crack along the driveway each side of the tracks, if the subsoil is impermeable clay or of such a nature as to retain water. At intersecting streets which cross the paved street, the crack does not continue across the intersection, presumably because the travel across street and around the corners packs snow and permits the frost to penetrate over sufficient area to raise the pavement uniformly without breaking it; but where the intersecting street comes in from one side only, the crack runs off toward the opposite curb as it approaches the intersection, and continues across the intersection, coming back to the crown again on the other side.

(e) A careful examination of the concrete foundation under the longitudinal crack will reveal the fact that the foundation is also cracked. Is this expansion? And yet the specifications of the National Paving Brick Manufacturers' Association, admirable and complete in most respects, make no provision for drainage except the statement that "If the ground is spouty clay, tile drainage should be provided to carry off the accumulation of wet;" and even this meagre suggestion is modified by the statement that "Underdrainage is not absolutely essential, but in wet and spouty clay under-

*From a paper before the Michigan Engineering Society.

stratum much is added to the durability of the structure by keeping the sub-foundation dry, and under foregoing wet conditions is the only way to accomplish the best results." No mention of frost. The report of the Asphalt Committee of the Organiziation for Standardizing Paving Specifications provides for drainage "when the soil is of such a character that it retains an excessive amount of moisture, such as clays subject to swelling or heaving under the action of frost;" but the report of the Brick Committee makes no mention of underdrainage. Techincal books also are uniformly vague on this subject, and the inexperienced engineer has little indeed to warn him of the danger of frost.

Inasmuch as it is an established fact that frost has no tendency to swell or heave any kind of soil from which the moisture is thoroughly drained, the writer ventures the opinion that the best way to prevent this form of cracking is to provide a suitable drain under each curb where the sub-soil is clay, and connect same with sewer inlets. Such drains should be placed about three feet below the top of the curb, and the trench over the drain filled up to the bottom of the curb with coarse material such as cinders or small field-stone. Placing cross-drains under the povement is probably to be discouraged, as water cannot penetrate through the pavement after it is once built, and there seems to be little necessity for making provision for carrying water from the middle of the pavement toward the surbs; and these cross-drains tend to carry water under the pavement during the wet season, where it may percolate through the sub-grade, rather than to remove it. Too shallow side-drains are also to be guarded against.

Also, the writer does not consider his observations sufficiently final to warrant the omission of expansion cushions next the curb, in view of the fact that all modern paving specifications require such expansion cushions. His personal opinion, however, is that they seldom if ever serve any useful purpose except on very wide pavements. It is undeniably true that after the crack is once started it continues to widen from the action of alternate expansion and contraction; but I have never seen a crack of this kind that appeared to have been caused by expansion originally.

2. *Expansion.* Expansion cracks occur on a hot day in summer, usually at a crown in the longitudinal grade of the paved street, where several courses of brick are sometimes thrown into the air with considerable violence, and when the repair gang comes to relay them they find that there is at least one row of the blocks which were thrown out that cannot be relaid. This form of cracking is quite spectacular, and furnishes exceptional opportunities for advertisers of bituminous fillers. At the same time the damage to the pavement is comparatively slight and easily repaired.

Where there is no abrupt change of grade to permit the pavement to buckle, the observations of the writer seem to indicate that the filler between the brick courses is sometimes crushed in places, and the surface cracked into diamond-shaped or triangular divisions, the cracks following the joints and seldom breaking a brick. If there is a bend or angle in the paved street, the effect of expansion will be carried to this point of weakness, and will shove the angle considerably out of line.

The specifications of the National Paving Brick Manufacturers' Association provide expansion cushions along the curbs only, no transverse joints. The report of the Brick and Granite Block Committee of the Organization for Standardizing Paving Specifications also provides for longitudinal expansion joints only, being practically copied from the specifications of the National Paving Brick Manufacturers' Association. I understand that he secretary of the association, Mr. Will P. Blair, maintains that the longitudinal expansion, failing to find room to act longitudinally, is in some mysterious manner transformed into transverse expansion, and is then taken care of by the side cushions. This may be true to the extent that the breaking of the surface into diamond-shaped or triangular areas probably has a tendency to force the brick apart and outward toward the curb to some extent; but this is taking care of the expansion after it has done its damage.

These diagonal cracks, zig-zaging along the brick joints, are inconspicuous, and in fact are often not visible except at such times as foggy mornings, when each crack is outlined by a line of moisture. They are not conspicuous like the longitudinal crack caused by frost, and make no spectacular expansion like the failure by buckling of the paved surface; but they extend over the whole surface of the pavement, tending to destroy its waterproof condition, and forming starting points for the jar of heavy traffic to begin its destructive action; and no

doubt shorten the life of the pavement much more than the widely advertised buckling, which is all in one place and easily repaired.

It is believed that the most logical method of preventing this form of failure is to provide frequent transverse expansion joints, and that these joints are best formed by laying several courses of brick about one-fourth inch apart and filling these quarter-inch joints with a suitable bituminous filler before grouting the balance of the pavement. The use of single expansion joints one-half inch or more in width is to be condemned for several reasons: it makes a bump for loaded vehicles, causing a hammering action on the adjoining brick which soon loosens them, and the fault this started spreads rapidly under traffic; the bituminous filler is very apt to run in a wide joint from the crown toward the curbs in warm weather; the expansion sometimes forces the bottoms of the blocks next the expansion joint together, while the tops are held apart by earth, etc., which has become packed into the joint, causing the brick to heave up next the joint.

3. *Settling of Sand Cushion.* This occurs from several sub-causes:

(a) If the sand cushion is spread on a macadam foundation, it is apt to work down into the foundation in places and cause unequal settlement, thereby breaking the paved surface. One or two cities, at least, have had disastrous results from attempting to lay brick pavements on macadam foundation in this manner. It could probably be avoided by filling and rolling the macadam foundation in about the same manner as for a finished macadam pavement, but there would usually be no economy in that. It is believed that a good concrete foundation is the most economical in the long run, except possibly under some very exceptional conditions.

(b) If sufficient care is not exercised in forming the surface of the concrete foundation parallel with the plane of the required pavement surface, the sand cushion will be of varying thickness, and therefore liable to settle unevenly.

(c) The foundation having been properly laid, if the cushion is carelessly luted it will still be of unequal thickness; or if spread with a templet, and the templet is not carried back and drawn over the surface several times, the surface will invariably be wavy and cushion of unequal thickness. It is a serious mistake to leave the sand cushion uneven, depending on the rolling to level it. The roller will probably make it appear quite level, but some of the blocks will be well bedded while others will have received practically no benefit from the rolling, and these will naturally settle later under traffic.

(d) If the sand is partly dry and partly moist when spread, it will naturally settle unevenly. If the sand were all uniformly moist, the settlement would perhaps be as uniform as though dry sand were used; but a pile of sand is often dry on the outside and damp inside, or vice versa, and may not be thoroughly mixed in spreading. When such sand is used it should be dried, or if it were moistened uniformly by sprinkling the same purpose might be served.

Cracks caused by settling of sand cushion are usually roughly retangular, do not break across the bricks, and the inclosed rectangle drops below the balance of the pavement. These rectangles vary in size from two or three bricks to several square yards. They go down under traffic sufficiently heavy to break the bond of the grout, and if the bond does not break an arch is formed, giving rise to the rumbling noise so often complained of. If not repaired at once the fault spreads rapidly, under the hammering action of traffic, over the surface of the adjoining pavement.

The proper thickness of the sand cushion has been the subject of much discussion. The writer believes that any thickness from one to two inches is all right, if properly applied. Some have claimed that a mortar-bed, in place of the sand cushion, is the panacea for all these difficulties. It is probable that a mortar-bed properly prepared would give satisfactory results, as it has been extensively and successfully used for creosoted wood block pavements. The sand cushion is probably equally good, or better, if carefully and properly handled.

4. *Settling of Sub-Grade.* This fault is also due to various sub-causes:

Pavements laid across fills are very apt to settle. It is only with the greatest care that a fill can be made so that it will not settle more or less.

Improperly filled trenches for sewer, water and gas pipes, etc., often cause settlement many years after the pavement is laid. The pavement arch is strong enough, perhaps, to bridge the trench when settlement first starts, but as the earth from the sides of the trench is gradually jarred down the span widens until it becomes too broad to support the load of traffic. Too

great care can hardly be exercised in properly back-filling such trenches.

Very wet and undrained sub-grade sometimes is the cause of this trouble. Suitable side drains would usually remedy the matter when moisture is the cause.

5. *Contraction Between Transverse Expansion Joints.* When expansion joints are placed a considerable distance apart, it is noted that fine cracks appear at intervals, following the grouted joint from curb to curb. Where expansion joints are fifty feet apart two such cracks appear in the fifty feet, dividing the pavement into sections of about one rod in length. These cracks are hardly noticeable, and sometimes can only be observed at certain times when outlined by moisture.

It is believed that they should be obviated by placing the transverse expansion joints only about fifteen feet or a rod apart. It would then be necessary to fill only one or two joints with the bituminous filler at each place.

It is hoped that these suggestions and the discussion which they may bring out at this time may be of value to those of our profession who, like the writer, must rely largely upon the experience of others for guidance in their work.

Hydro-Electric Practice

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Design of Plant

IN my preceding articles the discussion has been brought to the point where the development scope and program have been determined. The available potential flow volume of the natural or regulated discharge has been clearly established, as well as the maximum obtainable fall, and the project has advanced to the stage when the required works are to be designed and the equipment is to be specified.

The designing of the plant requires an analytical knowledge of the topography and geological formations at and in the vicinity of the sites to be occupied by the works, which is obtained from detail surveys and from borings and tests of rock and alluvial materials.

The most reliable foundation for the topographical surveys is a well selectedquadrilateral with two stations on either shore, one side being accurately measured as a base-line and the four angles being read to the closest agreement. These four triangulation points should be marked in a permanent manner so that they may be accessible until the works are completed. The river banks are then to be cleared of timber and brush for double the width required for the restraining works and well above the highest level of pondage and parallel cross section lines are to be carried up both lines at ten-feet intervals and fifty-feet points marked by hubs. These are referred to the center line of the section and begin at a zero line along the river shore. After cross section lines are established, permanent benches are established at the most convenient zero points at either shore, being on a horizontal plane, and from these the precise elevation of each of the cross-section hubs is determined and marked on them. Where the difference in elevation between adjoining hubs exceeds two feet the intermediate space must be contoured to one-foot intervals.

Bank sectioning being completed, the lines are extended across the river channel, soundings being taken at ten feet intervals on each line. When water depth and current permit this is to be done by walking across, the most economical method, otherwise it is advisable to stretch a wire or rope across above the upstream line and sound from a raft hanging from this cable. The raft is most readily constructed from planking secured to empty barrels. The guide ropes should be secured to blocks passing along the cable. The raft should be roomy enough to permit four men to operat conveniently, two attending to the cable guides, one sounding and the fourth taking the record. Side lines are secured to the raft, reaching both shores, by which the raft is pulled across ten feet at a time, these lines being tagged at ten-feet intervals. When water depth exceeds eight feet or the current is swift, the sounding is best done by aid of a reel with weighted wire secured to it and a clock dial and rigid hand, the

dial being subdivided into ten spaces and tenths subdivisions in ratio to the diameter of the reel. The sounding reel stands in the center of the raft. During the river sounding a gauge, with its zero referred to reference plane, is read for each sounding.

This refers specifically to the dam site, but those of the power station and tailrace channel, and of diversion works locations are similar. The subsurface formations on all sites must be clearly developed by sinking pits in alluvial deposits and making diamond drill borings in rock formation, and these borings must be sufficiently plentiful so that no reasonable doubt remains as to the depth and character of the different materials and dip of the rock strata. All these subsurface examinations are referred to the reference plane for elevations. The data secured from these surveys are mapped on a large enough scale to make one foot depth or length measurable and the material samples are classified and tested for permeability, porosity and crushing resistances.

These surveys and examinations can not be excessively minute or precise, as economical designing is practicable only when these conditions may be read like an open book; if there is doubt as to formations below, it must be insured by perhaps unnecessary and costly safeguards, and if the surface topography is insufficiently developed the structural quantities may fall short of those required and render the estimate of cost unreliable.

A second preparation for designing of plant is the collection of all available information concerning construction materials. This relates chiefly to timber for coffer dam, concrete forms and other purposes and the concrete aggregate, sand gravel and suitable rock for crushing. The proximity, quality and quantity of these materials should be ascertained and the probable cost of delivering them to the development site.

The restraining works are first considered. They consist of some spillway section flanked by reservoir dams to the extent of the river valley to be closed. The type of recommendable spillway is determined from the required height, foundation character and flood-water volume to be passed over it. For a height of twenty feet and less a timber structure may be considered, provided suitable material is obtainable within close proximity. A timber spillway may be of crib, trestle or gravity design. Either of them will, when constructed of sound material, make a safe and durable structure, and their first cost may be considerably less than that of a concrete or masonry spillway. When the height exceeds twenty feet the cost of timber structures equals and soon exceeds that of other types. The foundation conditions should decide the type of higher spillways. On alluvial formations a gravity spillway may prove the most economical. This form is designed to eliminate the horizontal water pressure by giving the upstream face a 45 degree inclination downstream, on which the vertical and horizontal water thrusts are balanced. This spillway consists of a concrete-steel shell braced by transverse partitions. It represents little weight as compared with a solid masonry mass, and sub-surfaces seepage does not endanger its stability. Many of these spillways have been constructed since concrete-steel construction has been perfected, some to heights exceeding one hundred feet, and they have proven themselves to be satisfactory. On hard rock the monolithic concrete ogee-shaped spillway remains the standard type and where the material is in close proximity the cyclopean structure represents some economy. For a height exceeding one hundred feet a masonry structure of coursed stone is the most recommendable, as the weight becomes too great for safe crushing resistance of the average concrete. The flood volume to be passed over the spillway exerts an important influence on its design, both because of the effect of the increased horizontal pressure on the structure and on the river bed downstream of it, due to the overfalling water. When the overflow is likely to exceed one-tenth of spillway height, the design should provide other flood water passage opportunities, which leads to the type of open spillways which are provided with apertures ordinarily closed by some movable devices which can be opened to pass the flow. These are of many descriptions, but those available for water-power restraining works are limited to that class which guarantees water-tightness when closed, which comprises vertical lift, revolving segment, flutter and roller gates. Each of these types is represented by some variety of designs, their adaptability meeting specific conditions.

The spillway type being determined, its length must be fixed, which depends largely upon the flood flow volume. It is a good rule to make the spillway length not less than the width of the natural flood channel, though

this can not always be complied with economically, but whenever the channel is contracted, other flow passages should be created of sufficient discharge capacity to make up for the reduction of flow area from that which nature has provided. The spillway sections should always be designed for an overturning safety factor of not less than two. When the height exceeds 69 feet the upstream face should be battered downstream, whereby the pressure lines are inclined downward and the pressure lever arms are reduced in length. The spillway lip must be given the correct overflow curve and the downstream face must be shaped to insure adherence of the highest overflow to spillway surface. A sufficiently long apron must be provided, also some scouring sluices, to withdraw accumulated silt deposits and unwater the upper pool. Much more might be said of the restraining works, but space will not permit any broader treatment.

The diversion works may be open or closed conduits, canals, flumes or pipe lines. Canals should have a section which will pass the potential flow at a velocity not exceeding two feet per second. They must be water-tight and therefore require generally some impermeable lining. This holds good not only when canal location is in alluvial material, but also when in stratified rock. The flow prism must be protected against erosion and subsidences. On side-hill locations a berme of ten feet width must be provided above high-water level and the bank above paved. Canals must have ample spillway capacity, preferably near the ends, intakes and forebays to pass excess flow, ice and logs. Canals should be guarded by headgates, and it is recommendable to set up above them coarse trash racks, the service racks being arranged in front of the turbine chambers.

Flumes are applicable only when the flow is 100 c. f. s. or less; they are generally of timber construction, should be watertight and rigidly supported to prevent their sagging. They must be provided with waste weirs.

Pipe conduits may be wooden stave, concrete-steel or steel plate. The first are limited to pressure heads of 100 feet and must be kept constantly filled with water. The second are likewise limited to low pressure-heads, and even then it is difficult to prevent leakage. Steel-plate pipes are available for any head and can be made watertight.

Any conduit must be laid on rigid supports and preferably above surface. Air valves must be placed at all points where gradient changes, but no portion of the conduit should be above the hydraulic gradient. Manholes and mud-boxes should be provided at 500 feet intervals. Pipe lines require relief valves or standpipes to prevent injuries from pressure fluctuations. They should terminate at the power station in a receiver from which the water is drawn for the turbines.

The power station may be located at or near the dam or at a distance downstream of it. When at the dam its location should be selected to secure unobstructed tail-water discharge. Of recent years the station has been arranged in the interior of a hollow concrete-steel gravity dam, an arrangement which represents some economy in first cost and secures the highest obtainable flow and fall efficiency. The power station should be of ample dimensions, not less than 25 feet width per generating unit, and be of sufficient length to allow of placing transformer equipment in an isolated part; repair shop facilities should not be omitted. The structure should be fireproof and be well ventilated. Ordinarily very little attention is paid to the architectural features, though it is a matter of small expense to give the station an appropriate appearance.

The efflux arangements are as important for best efficiency output as those of influx; draft tubes should dip not less than three feet and have water cushion under them of at least five feet. The tailrace should have plenty of fall and be protected from spillway overfall by wing walls.

It goes without saying that the foundation of the power house must be equally as carefuly designed as the dam, and that the substructure, or pit, must be given absolute rigidity. All parts of the station building may preferably be of concrete and concrete-steel construction, the roof of steel frame and slate covering.

Standardizing of the Rattler Test for Paving Brick*

By Marion W. Blair, Indianapolis, Ind.

THE rattler test for paving brick has been a matter of more or less concern both to manufacturers and engineers for a period over twenty years. The need of some definite and standard method of determining the degree of those qualities recognized as requisite to a satisfactory pavement which any particular lot of brick may possess is unquestioned, these qualities being uniformity of structure, toughness and an ability to withstand abrasion and impact.

The object of this paper, therefore, is not to discuss an obvious need, but to point out certain deficiencies in a method supposed at one time to be scribe certain investigations which adequate for the purpose and to dehave been made in an attempt to relieve a situation which has come to be a menace on the one hand, a source of endless annoyance on the other, and which has lost to the manufacturers many thousands of dollars in legitimate profit and forced the taxpaying public of some communities to pay more than a legitimate price, without enhancement of quality, but shutting out competition, because of an importance attached to the test out of proportion to its real value, instead of to the service obtained in the street.

In 1896 H. J. Bart reported in the Technograph, University of Illinois, that in fifteen cities the specifications showed variations ranging in rattler and conditions of test as follows: Length of rattler, 24 to 54 inches; diameter, 15 to 40 inches; speed, revolutions per minute, 15 to 45 inches; duration of test, 30 to 36 minutes; weight of iron in the charge, 50 to 800 pounds; loss permissible in one hour, 3 to 10 per cent. These figures show something of the variation in practice at that time.

Even as late as 1909 the following was found in the specification of a Wisconsin city: "*Abrasion Test.* The abrasion test shall be made by the following proportions: Rattler, 28x48; 800 pounds scrap iron pieces varying in weight from ¼ to 5 pounds; 900 revolutions of 15 revolutions per minute; loss of weight shall not exceed 9 per cent."

It can be readily seen that such variation would lead to endless confusion. Comparisons of one city with another were impossible and the manufacturer was at sea as to whether or not the conditions could be met by his product. Experiments were made in the next few years by different investigators, notably by Professors Baker and Talbot of Illinois University, and Prof. Orton at Ohio State University.

In 1897 Prof. Orton, acting for a committee of the National Brick Manufacturers' Association, reported a standard method. Abrasive material other than the brick charge itself was omitted but the speed was fixed at thirty revolutions per minute, and the size of the barrel recommended as 28-inch diameter by 20 inches in length.

Defects in this test were soon pointed out by Prof. Talbot and others and it was shown that results obtained were not uniform or reliable. Owing to this irregularity and lack of uniformity in results, the N. B. M. A. undertook a further investigation, which was conducted by Prof. Orton during the year of 1899. These experiments were conducted on a machine in which the brick were clamped edgewise in pockets around the inside surface of a cylinder rattler and 1½-inch cubes of cast iron were used for impact and abrasing material. This device is known as the Jones Rattler and the report was submitted by Prof. Orton in January, 1901.

There were many objections to this device of Mr. Jones', so when the report was presented to the Association in February, 1901, further investigations were ordered. These investigations covered a series of experiments upon a machine similar to the Jones Rattler but which had been improved somewhat by Prof. Talbot and was then known as the Talbot-Jones rattler. Experiments were also made upon the other style of rattler and a report made to the committee in August, 1901. After a careful study of the evidence submitted, this committee recommended the adoption of what has since been known as the Standard N. B. M. A. test and it is with the further development of this test that the present investigation has been concerned.

In this specification the description

*A paper before the Indiana Engineering Society.

of the machine to be used is by no means accurate or complete. The only fixed dimension is that which says it shall be 20 inches in length. All others are left optional and not a word is said about the material to be used in the construction of same. Since taking up this work, the writer has had opportunity to examine machines in many localities and he has found all the allowable variations. He has found machines with staves ranging from ⅜-inch steel plate to 1⅛-inch. He has found at least four different patterns of cast iron and at least two different patterns of cast steel and two weights of structural channel in use. All of these variations, however, come within the recommendations of the N. B. M. A. specifications, and no provision is made as to manner and method of renewal or the amount of wear to be permitted.

The condition of the cast iron charge is even more deplorable. There is no system by which the charge has been kept up to standard weight or dimension, this feature being left entirely to the judgment of the operator, and the specification allows a variation of 10 per cent. in individual weights, so we have found charges ranging under normal from twenty to twenty-five pounds in weight, and absolutely no record or evidence that they had ever been standardized. In addition to this variation in weight, nothing is said as to the quality of the iron except that it shall be what is known as ordinary machinery cast iron.

The tendency, however, for the past ten years has been to find a material which would last the longest in the machine, but as this feature has not been of particular interest to those laboratories in which but few tests were made, there has grown up a condition in which scarcely any two machines in use are using iron abrasives of the same quality. In fact, until the present investigation, the effect of quality of the abrasive had scarcely met with any consideration.

The speed of the machine was fixed within fairly close limits, but the number of brick to be tested was 9, 10 or 11, and it is obviously unfair to submit brick of such a size that it requires 11 to make up 1,000 cubic inches to the same test as that of which it requires but 9 to make up the same amount.

The foregoing variations probably explain to a certain extent why it has been practically impossible to obtain results under the N. B. M. A. specification which checked one with another, even to a fair degree. These were the conditions found about a year ago when the writer was employed by the National Paving Brick Manufacturers' Association to investigate the subject and if possible arrive at some specification for the test which would produce uniformity of results. Prof. Orton, of the Ohio State University, volunteered to assist in this work and it was agreed that the experiments should be in all cases run in parallel so that the results of two laboratories using same methods and apparatus would be available for comparison.

Material was chosen and selected in such quantities as to give both laboratories a sufficient amount of a number of different brands or makes of paving brick to conduct over 1,000 tests each. A new machine was designed and duplicates were built for each laboratory. It was determined to carry on the investigation not only on the original test, without abrasive and the N. B. M. A. standard, using abrasives in the form of cubic and oblong block, but to conduct a new series of experiments using abrasives in spherical form, similar in weight to the cubes and blocks employed.

The results of the first two series thus run showed that while the spheres used by Orton had given average results considerably higher than those obtained by the use of cubes, the reverse was true in the results obtained by the writer. A study into the causes of such results disclosed the fact that the composition of the abrasive material varied greatly and that the abrasive action obtained increased in severity with the amount of combined carbon contained in the abrasive material. Further experiments led to the conclusion that it would be impossible to obtain like results unless the quality of the abrasive material was specified within rather close limits.

The effect of the condition of the staves of the machine was carefully noted and it was found that as the staves distorted, the severity of the machine increased. This distortion in some cases was very marked and showed after comparatively few tests. Experiments were made covering the following range of staves: ¼, ½, ¾-inch steel plate; two grades of cast iron; manganese steel; plain structural channel and structural channel with the face protected by a wearing plate. After a long series of tests, it was concluded that the latter named stave gave the most uniform condition of the barrel of the machine to be had

and gave closer uniformity in the results obtained.

A progress report of these experiments, which have covered a period of one year, so far, is referred to a little later on. The recommendations embraced in a rattler specification have been presented to the Organization of City Officials for Standardizing Paving Specifications and consideration of same is presented to this society.

While we believe that we have eliminated considerable variation from this machine, it must still be recognized that there remains a hazard in the machine itself which is unavoidable. Attention is also called to the charts herewith, which show a certain variation in weight and structure of the brick of the same make and, to all practical purposes, of the same grade.

RATTLER SPECIFICATIONS.

The machine shall be of good mechanical construction, self-contained, and shall conform to the following details and dimensions, and shall consist of barrel, frame and driving mechanism as herein described.

The Barrel. The barrel of the machine shall be made up of the heads, head-liners and staves.

The heads shall be cast with trunnions in one piece. The trunnion bearing shall not be less than 2½ inches in diameter or less than 6 inches in length.

The heads shall not be less than ¾ of an inch thick nor more than ⅞ of an inch. In outline they shall be a regular 14-sided polygon inscribed in a circle 28⅜ inches in diameter. The heads shall be provided with flanges not less than ¾ of an inch thick and extending 2½ inches from inside face of head, to afford a means of fastening the staves. The flanges shall be slotted on the outer edge, so as to provide for two ¾-inch bolts at each end of each stave, said slot to be 13-16 of an inch wide and 2¾ inches center to center. Under each section of the flanges, there shall be a brace ⅜ of an inch thick and extending down the outside of the head not less than 2 inches. Each slot shall be provided with a recess for the bolt head, which shall act to prevent the turning of the same. There shall be for each head a cast iron head-liner 1 inch in thickness and conforming to the outline of the head, but inscribed in a circle 28⅛ inches in diameter. This liner or wear plate shall be fastened to the head by seven ⅝-inch cap screws, through the head from the outside. These wear plates, whenever they become worn down one-half inch below their initial surface level, at any point of their surface, must be replaced with new. The metal of which these wear plates are to be composed shall be what is known as hard machinery iron, and must contain not less than 1 per cent. of combined carbon. The faces of the polygon must be smooth and give uniform bearing for the staves. To secure the desired uniform bearing, the faces of the head may be ground or machined.

The Staves. The staves shall be made of 6-inch medium steel structural channels 27¼ inches long and weighing 15.5 pounds per lineal foot.

The channels shall be drilled with holes 13-16 of an inch in diameter, two in each end, for bolts to fasten same to the heads, the center line of the holes being 1 inch from either end and 1⅜ inches either way from the longitudinal center line.

The space between the staves will be determined by the accuracy of the heads, but must not exceed 5-16 of an inch. The interior or flat side of each channel must be protected by a lining or wear plate ⅜ of an inch thick by 5½ inches wide and 19¾ inches long. This wear plate shall consist of medium steel plate, and shall be riveted to the channel by 3½-inch rivets, one of which shall be upon the center line both ways and the other two upon the longitudinal line and spaced 7 inches from the center each way. The rivet holes shall be counter sunk on the face of the wear plate and the rivets shall be driven hot and chipped off flush with the surface of the wear plate. These wear plates shall be inspected from time to time, and if found loose shall be at once re-riveted, but no wear plate shall be replaced by a new one, except as the whole set is changed. No set of wear plates shall be used for more than 150 tests under any circumstances. The record must show date when each set of wear plates goes into service, and the number of tests made upon each set.

The staves when bolted to the heads shall form a barrel 20 inches long, inside measurement, between wear plates. The wear plates of the staves must be so placed as to drop between the wear plates of the heads. These staves shall be bolted tightly to the heads by ¾-inch bolts, and each bolt shall be provided with lock nuts, and shall be inspected, at not less frequent intervals than every fifth test and all nuts kept tight. A record shall be made after each inspection, showing in what condition the bolts were found.

The Frame and Driving Mechanism. Investigation into the effects of variations in the construction of the frame, and in the mode of driving the barrel, has not yet been undertaken and hence no established accuracy is offered at all comparable to that which has been reached in the construction of the barrel and uses of shot herein set forth. Without insisting, therefore, upon absolute uniformity in the frame or driving mechanism, the following principles of constructions are recommended, pending the completion of further studies upon the points involved.

The barrel should be mounted on a cast-iron frame of sufficient strength and rigidity to support same without undue vibration. It should rest on a rigid foundation and be fastened to same by bolts at not less than four points.

It should be driven by gearing whose ratio of driver to driven should not be less than one to four. The counter shaft upon which the driving pinion is mounted should be belt-driven and the pulley should not be less than 18 inches in diameter and 6½ inches in fact. A belt of 6-inch double-strength leather, properly adjusted so as to avoid unnecessary slipping, should be used.

The National Paving Brick Manufacturers' Association will furnish without cost to all proper applicants, the complete drawings of a machine which will meet the above specifications and requirements.

The Abrasive Charge. (a) The abrasive charge shall consist of two sizes of cast-iron spheres. The larger size shall be .75 inches in diameter when new and shall weigh when new approximately 7.5 pounds (3.40 kilos) each. Ten shall be used.

These shall be weighed separately after each ten tests, and when the weight of any large shot falls to 7 pounds (3.175 kilos) it shall be discarded and a new one substituted, provided, however, that all the large shot shall not be discarded and substituted by new ones at any single time, and that so far as possible the large shot shall compose a graduated series in various stages of wear.

The smaller size spheres shall be, when new, 1.875 inches in diameter and shall weigh not to exceed 0.95 lbs. (0.430 kilos) each. Of these spheres so many shall be used as will bring the collective weight of the large and small spheres most nearly to 300 lbs., provided, that no small sphere shall be retained in use after it has been worn down so that it will pass a circular hole 1.75 inches in diameter, drilled in a cast-iron plate ¼ inch in thickness, or weigh less than 0.75 lbs. Further, the small spheres shall be tested by passing them over such an iron plate, drilled with such holes, or shall be weighed after every ten tests, and any which pass through or fall below specified weight, shall be replaced by new spheres, and provided further that all of the small spheres shall not be rejected and replaced by new ones at any one time, and that so far as possible the small spheres shall compose a graduated series in various stages of wear. At any time that any sphere is found to be broken or defective, it shall be at once replaced.

(b) The iron composing these spheres shall have a chemical composition within the following limits:

	Per Cent.
Combined carbon	Not less than 2.50
Graphite carbon	Not more than 0.10
Silicon	Not more than 1.00
Manganese	Not more than 0.50
Phosphorus	Not more than 0.25
Sulphur	Not more than 0.08

For each new batch of spheres used, the chemical analysis must be furnished by the maker, or be obtained by the user, before introduction into the charge, and unless the analysis meets the above specifications, the batch of spheres shall be rejected.

The Test. The rattler shall be rotated at a rate of not less than 29½ nor more than 30½ revolutions per minute, and 1,800 revolutions shall constitute the standard test.

A margin of not to exceed ten revolutions will be allowed for stopping. In case a charge is allowed to run several minutes beyond its proper termination, and the loss incurred is still within the prescribed limits, then the test shall not be discarded, but the fact shall be entered on the record.

Stopping and starting. Only one start and stop per test is regular and acceptable. If from accidental causes a test is stopped and started twice extra, and the loss exceeds the maximum permissible, the test shall be disqualified and another made.

A counting machine shall be attached to the rattler for counting the revolutions.

The Results. The loss shall be calculated in percentage of the original weight of the dried brick composing the charge. In weighing the rattled brick any piece weighing less than one pound shall be rejected.

Records. (a) The operator shall

keep an official book, in which the alternate pages are perforated for removal. The record shall be kept in duplicate, by use of a carbon paper between the first and second sheets, and when all entries are made and calculations are completed, the original record shall be removed and the carbon duplicate preserved in the book. All calculations must be made in the space left for that purpose in the record blank, and the actual figures must appear. The record must bear its serial number and be filled out completely for each test and all data as to dates of inspections, and weighing of shot, and replacement of worn-out parts must be carefully entered, so that the records remaining in the book constitute a continuous one. In event of further copies of a record being needed, they may be furnished on separate sheets, but in no case shall the original carbon copy be removed from the record book.

(b) The blank form upon which the record of all official brick tests is to be kept and reported is as follows:

[The form of record is not herewith reproduced.—EDITOR.]

Asphaltic Oils in the Preservation of Railway Ties*

By Frank W. Cherrington, Cincinnati, O.

The results obtained in the asphaltic crude oil treatment of railway ties by the Santa Fe railroad and the Mexican National railways have proven the fact that water-proofing asphaltic crude oils have a claim for serious consideration as successful wood preservatives.

As early as 1885, a report was made by the committee on wood preservation of the American Railway Engineering and Maintenance of Way Association, which concluded with the statement that crude petroleum would prove a preservative so long as it would continue to saturate the wood by the exclusion of water, but that if injected once and for all, its volatile nature would result in its evaporating and leaving the timber unprotected. This report was made after a thorough investigation of the eastern crude paraffin petroleum, which had continually dripped on the railroad bed in the oil-producing region, and prolonged the life of the ties in the tracks. These paraffin oils are not stable in their composition, being susceptible to the disintegrating influence of the action of the elements, and therefore, in order to secure results by the exclusion of water, a continual application of fresh oils became necessary.

About fifteen years later, the Santa Fe railroad injected Bakersfield, California, asphaltic crude oil into pine ties and laid them in a section of track in southern Texas, where the climatic condition is one of the most severe, for ties, to be found in North America. A maximum quantity of oil was forced into these pine ties, the absorption per tie being, of course, dependent upon the amount of heart and sap wood in each tie.

An investigation of the asphaltic crude oils located in sections of the country other than California or Mexico discloses the fact that, in their natural condition, they are volatile, highly inflammable and not sufficiently viscous to prove of value as a wood preservative; therefore, it is necessary to refine oils having an asphaltic base, in other localities, thereby securing preservative oils which are similar and, in some instances, superior to the western asphaltic oils.

In the attached table No. 1 may be found a complete analysis of three asphaltic oils, viz.: the western Bakersfield (Cal.), asphaltic crude oil now in use by the Santa Fe railroad at Albuquerque, N. Mex.; the Mexican Ebano asphaltic oil; and finally, the refined product of an asphaltic crude oil found in the central United States. All of these oils are obtainable in large quantities and at low cost. The analysis of the refined asphaltic oil obtainable from the central United States is presented as a representative of what may be accomplished by refining the asphaltic crude oils of the east, and thereby securing an asphaltic residual oil which is practically non-volatile, non-inflammable, and at the same time, not nearly so viscous or hard to handle by the average plant equipment as the

* A paper before the Wood Preservers' Association at Chicago.

California crude product of the Mexican Ebano oil.

The following discussion of the "Analysis of a Residual Oil," which had been refined from an asphaltic base crude oil, taken from the central United States, has recently been submitted as the first progress report of the Government Forests Products Laboratory, at Madison, Wis., the object of which is to determine the value of this residual oil as a wood preservative.

"The distillation data show that the fractions from this oil have rather high boiling points, comparing in this respect very favorably with good coal-tar creosotes. The index-of-refraction values of the fractions lie in a range generally assigned to crude oils. These observations would be expected of an oil which, according to the manufacturer's description, is a residue left on distilling off the lighter fractions from the crude oil.

"Both the flash and burning points are high. This is a desirable property from the standpoint of fire risk.

"The viscosity curve represents from the wood-preservation viewpoint undesirable properties, as it is found necessary to heat the oil to 80 degrees C before readings could be obtained on the viscosimeter. It is, therefore, more difficult to circulate this material through pumps or pipe than coal-tar creosote."

The last paragraph of this report has been found to be true in actual tests, as creosote is naturally easier to handle in pumps and pipes than the more viscous asphalt oils. In actual prac-

TABLE NO. 1.

COMPARATIVE TESTS MADE BY A., T. & S. RAILWAY ON BAKERSFIELD, CAL., ASPHALTIC CRUDE OIL, SUCH AS IS BEING USED FOR TREATING BY THE SANTA FE PLANT AT ALBUQUERQUE, N. M., AND THE INDIAN REFINING CO. ON TIMBER ASPHALT.

	Mexico Ebano	California Bakersfield	Central U. S. Timber asphalt
Flashes in closed tester at deg. F	176	256	410
Flashes in open tester at deg. F	190	268	470
Degrees Beaume at 60 F	12.1	11.9	19.2
Specific gravity at 60 F	.9849	.9867	.9388
Distilling Tests using a retort (per cent coming over)—			
0 C. to 100 C., per cent	.....	.....	.....
100 C. to 150 C., per cent	1.0	.....	.....
150 C. to 300 C., per cent	20.1	15.0	.....
Distilling Tests using flash thermometer opposite take-off—			
0 C. to 100 C	.....	.....	.....
100 C. to 150 C	1.1	.....	.....
150 C. to 300 C	22.6	16.0	23.5
Evaporation Tests, placed in open dishes in air oven at 140 F.—oil 1.4 in. deep—			
In 24 hours, per cent	6.8	2.3	.....
In 96 hours, per cent	9.4	4.6	.....
Evoporation Tests, placed in open dishes in air oven at 200 F.—oil 1 in. deep—			
In 24 hours, per cent	9.8	4.8	.033
In 96 hours, per cent	11.4	11.5	.132

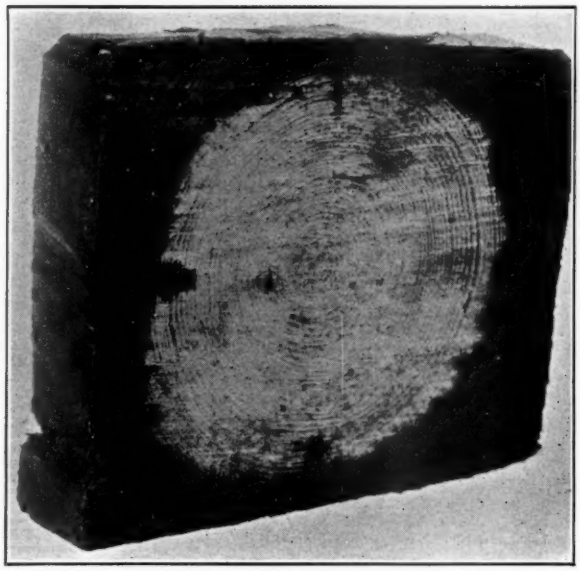
Fractional Distillation (Standard method)—

	Creosote	California Bakersfield		Central U. S. Timber asphalt
Specific gravity at 38 C	1.04	0.965		.928
Below 210, not more than (per ct.)	5	0.50	water	.333
210 to 235, not more than (per ct.)	25	0.60	naphtha and water	.50
235 to 270	....	1.50	light oil	34.166
270 to 315	....	6.70	gasoline	
315 to 355	....	14.50	kerosene	
Residue	....	75.00	asphaltum	65.00
Specific gravity of residuum at 38 C		0.99		

NOTE.—Bakersfield oil has been exposed in an open pan for one year, and so far has shown practically no loss by evaporation.

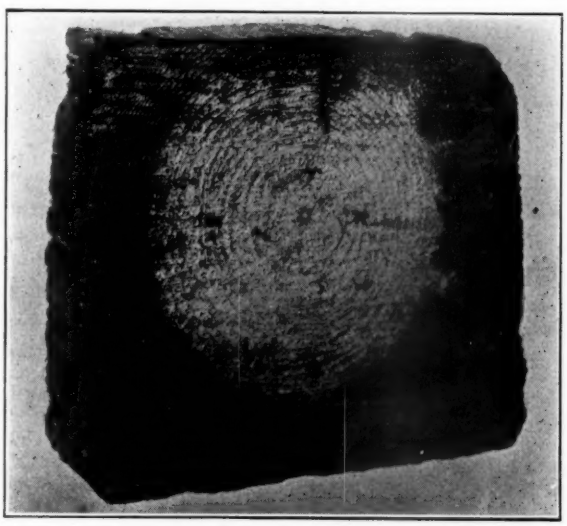
Viscosity Tests.—Using Scott's viscosimeter, in which 200 c.c. oil is put in the viscosimeter and the number of seconds required to pass 50 c.c through a small artifice is recorded. The standard for this machine is 11 seconds for 50 c.c. distilled water at 60 F.

	Mexican Ebano	California Bakersfield	Timber asphalt	Creosote
Oil heated to 100 F	3,000	1,565	595	18
Oil heated to 150 F	339	238	115	16
Oil heated to 200 F	110	44.5	32	15
Oil heated to 220 F	70	31.5	23	11
Oil heated to 250 F	40.5	22	20	11



LONG-LEAF PINE TIE

Treated with Timberasphalt, Pressure Process. Mt. Union Plant of Pennsylvania Railroad.



SHORT-LEAF PINE TIE

Treated with Timberasphalt, Preessure Process. Mt. Union Plant of Pennsylvania Railroad.

tice, however, at the several tests on plants of standard equipment, the pumps and valves were not affected to any appreciable degree by the viscosity of the oil.

During the month of April, 1910, various tests were made at the C. B. & Q. experimental plant at Galesburg, Ill., by a representative of an eastern refining company in order to thoroughly investigate the properties of this refined grade of an asphaltic oil as a wood preservative. Tests were run to determine whether this more economical oil could be used as a substitute for creosote oil in the Card process. In this test a mixture of 23 per cent. of asphaltic oil and 77 per cent. of a 5 per cent. zinc chloride solution was used. The results from this experiment proved that asphaltic oils could not be used in the Card process, because of the formation of a viscous emulsion, or saponification, which permitted the zinc chloride to penetrate the wood in large quantities but prevented the entrance of asphaltic oil into the wood. The fact that the zinc solution separated from the emulsion and penetrated the wood, leaving a thick mass of oil and emulsion distributed either irregularly through the wood or on the exterior of the timber, proved the futility of trying this process further, especially as the mixture was exceedingly hard to handle in the pumps and valves.

TABLE NO. 2.

C., B. & Q. EXPERIMENTAL CYLINDER, GALESBURG, ILL.

NOTE.—This table was too large to reproduce in full. It showed the length of time the ties had seasoned; the time in vacuum, under pressure, in vacuum again, time of steaming, preparation of tie, place in retort of each tie, volume of tie and absorption per tie, and per cubic foot. Each run showed the individual results on four ties. The results given below, except where but one volume of tie is given, are the averages of those for the four ties in each run.

STRAIGHT ASPHALTIC CRUDE OIL PROCESS.

Species of wood	Volume of tie, cu. ft.	Absorption per tie	Absorption per cu. ft.	% of vol.	Remarks
Red Oak	2.63 to 3.85	15.75	5.38	9.24	Penetration good.
Red Oak	2.82 to 3.09	12.37	4.27	7.33	Penetration good.
Red Oak	2.61 to 2.96	17.00	6.21	10.65	Penetration good.
Short Leaf Pine.	2.38 to 2.66	49.50	19.24	33.07	Saturated.
Beech	2.49 to 3.01	14.50	5.29	8.98	Penetration 1 in.
Beech	2.55 to 2.87	18.00	6.61	11.35	Penetration good.
Elm	2.66 to 3.07	19.50	6.94	11.92	Penetration good.
Soft Maple	2.63 to 3.02	14.75	5.20	8.98	Penetration ½ in.
Soft Maple	1.92 to 3.20	16.00	6.10	10.52	Penetration poor.

CARD PROCESS.

Using 23 per cent Asphaltic Crude Oil and 77 per cent of 0.5 per cent. Zinc Chloride Solution.

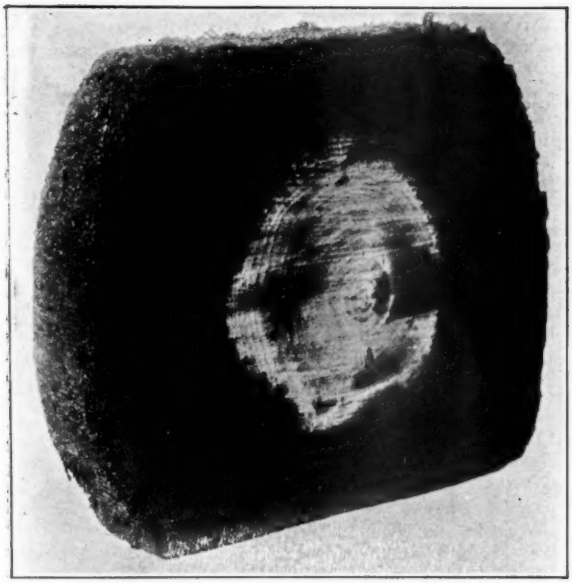
Hemlock	2.81	10.5	3.73	.....	Penetration ⅛ in.
Tamarack	2.63	10.5	4.00	.....	Penetration ⅛ in.
Beech	2.63	28.5	10.83	.....	Saturated with oil and zinc. Zinc found center heart all ties.
Red Oak	2.83	44.5	15.72	.....	Fair penetration of zinc and oil. Zinc found at center of heart by borings analysis.
Red Oak	2.34 to 3.07	28.0	10.32	.....	Well treated with both zinc and oil.
Red Oak	2.92 to 3.15	31.8	13.02	.....	Oil thoroughly distributed
Red Oak	2.37 to 3.01	24.1	9.31	.....	Coating of oil ¼ in. Zinc found at center of heart
Tamarack	2.34 to 2.90	14.2	5.46	.....	Well penetrated with zinc
Tamarack	2.51 to 3.22	21.2	7.79	.....	and oil.
Hemlock	2.47 to 2.78	16.4	6.41	.....	Oil penetrated ½ in.

TREATMENT WITH 25 PER CENT CREOSOTE TO 75 PER CENT ASPHALTIC CRUDE OIL.

Beech	2.51 to 2.91	7.80	21.13	12.91	Thorough penetration.
Beech	2.53 to 2.71	10.83	28.38	17.93	Thorough penetration.
Red Oak	2.75 to 2.91	9.54	27.00	15.80	Thorough penetration.
Red Oak	2.67 to 2.88	7.54	21.12	12.48	No sample taken.

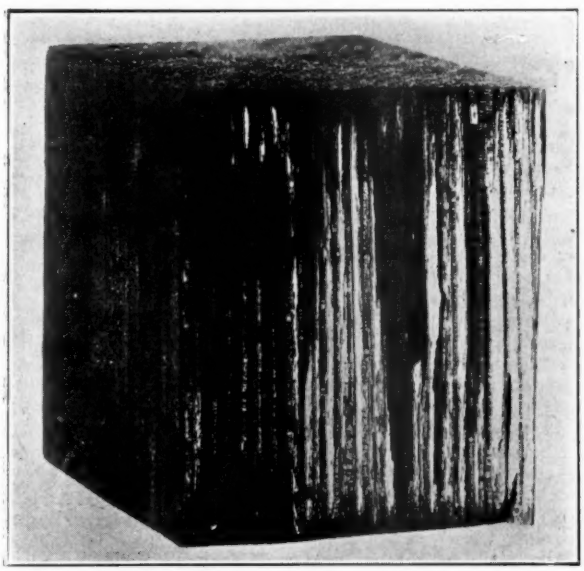
After determining the fact that the asphaltic residual oil could not be successfully used in the Card process, additional test runs were made to determine with what degree of success the straight asphaltic oils could be injected into the wood, and finally a mixture of 75 per cent. of asphaltic oil to 25 per cent. of creosote. The detailed results of the treatment, absorption and penetration secured in these tests are given in Table No. 2.

The experiments at Galesburg demonstrated that fairly good penetration could be secured on the various oaks,



WELL-SEASONED RED OAK TIE

Treated with Timberasphalt, Pressure Process. Mt. Union Plant of Pennsylvania Railroad



LONG-LEAF PINE PAVING BLOCK

Treated with Timberasphalt by Pressure Process, Sixteen Pounds per Cubic Foot.

elm, beech, gum, etc., ties, when injecting all the preservative the ties would absorb. This maximum amount was found to be about 7 pounds per cubic foot, as may be seen from Table No. 2. Pine ties (short leaf) were found to readily absorb the straight asphaltic oil in good quantities with thorough penetration.

The treatment with 25 per cent. creosote to 75 per cent. asphaltic oil proved that the viscosity of the oil was greatly reduced and absorption could be obtained as with straight creosote with a greatly reduced cost of treatment.

In order to determine whether the same proportion of 25 per cent. creosote to 75 per cent. asphaltic oil existed in the tie after its injection, a sample of the borings extracted from several ties injected with this mixture was taken and analyzed by a competent chemist, which proved that the mixture remained in a stable and homogeneous combination. The analysis secured from the boring extractions from the treated ties was ultimately compared with the analysis of the mixture remaining at the end of the test and the original creosote oil. The boring samples were analyzed for specific gravity, moisture content and amount of tar acids present. Finally, a fractional distillation of each of the three samples was made, taking the fractions in each case at the same temperature and determining the percentage, specific gravity and refraction of each. The results are tabulated in Table No. 3.

From the results secured in the comparative analyses of the oil extracted from the borings of the treated ties, the original creosote oil and the original mixture of 25 per cent. creosote to 75 per cent. asphaltic residual oil, it is safe to state that the mixture found in the treated ties approached the original proportions, and that the mixture injected into the ties contained about the same proportion as the original mixture before injection; hence, the mixture of creosote and asphaltic residual oil obtained from the central United States remained in homogeneous solution before, during and after its injection into the wood.

In the fall of 1909, the refining company shipped a large tank car of heavy asphaltic residual oil to the low pressure plant of the Indianapolis, Columbus & Southern Traction Company, at Columbus, Ind. At that time a cooperative agreement was entered into between the refining company to furnish the plant and ties, and the Forest Service of the United States Government to supervise the tests and to record the experimental data. This initial test at Columbus, Ind., proved a failure because of the inability of the small capacity pressure pump at the treating plant to handle the thick, viscous asphaltic residual oil which was at that time a grade very much heavier than the product which has eventually been adopted by the refining

TABLE NO. 3.

OIL EXTRACTED FROM BORINGS.

Spec. Grav. at 60 F..... .99416
Water .....None
Tar Acids, per cent..... 1.5

Distillation.

	Pct.	Spec. Grav.	Ref.
190 to 220 C..	2.0	1.012	1.558
225 C.	2.3	1.020	1.567
230 C.	1.8	1.022	1.573
240 C.	2.5	1.029	1.578
250 C.	2.2	1.019	1.571
260 C.	2.6	.9987	1.541
270 C.	3.2	.9788	1.511
285 C.	3.8	.9524	1.487
300 C.	3.5	.9413	1.476
315 C.	2.0	.9318	1.472
330 C.	5.7	.9467	1.474
345 C.	5.2	.9416	1.479
360 C. 40.5		.9409	1.483
Res. 22.1			

SAMPLE MARKED "ORIGINAL CREOSOTE OIL."

Spec. Grav. at 60 F.....1.049
Water, per cent.....1.0
Tar Acids, per cent.....6.7

Distillation.

	Pct.	Spec. Grav.	Ref.
170 to 220 C..12.16		1.017	1.568
225 C.	9.24	1.024	1.594
230 C.	6.96	1.029	1.612
240 C. 10.08		1.038	1.617
250 C.	8.76	1.049	1.621
260 C.	6.32	1.066	1.630
270 C.	4.56	1.078	1.637
285 C.	5.20	1.088	1.644
300 C.	5.52	1.096	1.650
315 C.	5.32	1.108	1.652
330 C.	6.24	1.117	1.659
345 C.	6.76	1.121	1.662
360 C.	3.60	1.130	1.664
Res.	8.40		

SAMPLE MARKED "RUN 167—END—MIDDLE."

Spec. Grav. at 60 F..... .9908
Water, per cent.....18.6
Tar Acids, per cent..... 1.8

Distillation.

	Pct.	Spec. Grav.	Ref.
170 to 220 C..	2.4	1.009	1.551
225 C.	3.0	1.018	1.563
230 C.	2.2	1.026	1.568
240 C.	2.0	1.034	1.572
250 C.	3.4	1.019	1.566
260 C.	3.1	.9996	1.546
270 C.	3.5	.9891	1.522
285 C.	4.4	.9769	1.486
300 C.	5.0	.9655	1.471
315 C.	4.2	.9567	1.475
330 C.	4.5	.9432	1.473
345 C.	4.1	.9429	1.477
360 C. 38.9		.9411	1.489
Res. 19.0			

company as a more satisfactory material. Before this test was completed, however, it was found that the asphaltic oil resisted the forcing of zinc chloride solution through an injection of three pounds of asphaltic oil per cubic foot to a very much greater degree than the same quantity of creosote. This proved the superior water-proofing quality of the asphaltic oil, as it is safe to assume that a material which would resist the forcing of a water solution through such a limited injection as three pounds per cubic foot, would successfully resist the action of water even under abnormal conditions to which treated material is generally subjected.

One other test, made at the laboratory of the above mentioned refiner, may prove of interest in showing the additional water-proofing quality of the asphaltic oil. A paving block of standard size was treated with residual asphaltic oil to the amount of 16 pounds per cubic foot. It was then dried in an oven of a temperature of 120 degrees F. for a period of 24 hours. The gain in weight was found to be .02 of 1 per cent. The same block, if treated with 20 pounds per cubic foot of creosote, would have been allowed to absorb as high as 3 or 4 per cent. of water, by weight.

The most recent test on asphaltic oils occurred in November, 1910, when several tank cars of asphaltic residual oil were shipped to the Mount Union plant of the Pennsylvania Railroad Company for a trial in the large cylinder at that plant. At this test, three charges were run with straight asphaltic oil, and three with a mixture of 33 1-3 per cent. creosote to 66 2-3 per cent. asphaltic oil. When this proportion of asphaltic oil and creosote was exhausted, more creosote oil was added as required until the proportion again assumed 100 per cent. creosote. The tabulated results given in Table No. 4 give in detail the treatment of these charges. Each charge averaged about 500 ties of 7x9x8½ dimensions.

Sections sawed out of the center of the pine ties showed complete penetration through the sap wood to the heart, this being an equivalent penetration to that secured by the use of creosote.

It was found that red oak, beech, elm and gum ties varied in the penetration secured, being dependent upon the amount of sap and heart wood in each tie. The penetration was not equivalent to that secured by creosote in all cases, but approached very nearly the results secured through the use of creosote. When the difference in viscosity between the two oils is considered, this result is not remarkable.

In each of the straight asphaltic runs, eight ties were marked and weighed before treatment, being selected as average samples from among the 500 ties composing each charge, and placed in various positions in the cylinder. After the process of treatment had been completed, the ties were again weighed and the absorption results of two charges with straight asphaltic oil are given in Table No. 5.

Reference to Tables No. 4 and 5, proves that the absorption per tie in the various woods was not excessive, at the same time giving good penetration in almost all cases; therefore, considering the fact that the asphaltic oil was not absorbed in large quantities when the woods were given a maximum treatment and again giving a penetration comparing favorably with that secured by the use of creosote, asphaltic residual oils may be considered an economical substitute for creosote.

The results secured on the mixture of creosote and asphaltic oils, as may be observed from the results in Table No. 4, proved, in every instance, as far as absorption per tie and the element of time for treatment may be concerned, equivalent to the results secured by the use of straight creosote oil. It must be admitted, however, that the asphaltic oils when used alone require a larger period of time for injecting an equivalent quantity of creosote, which quantity has been observed to be, in most cases, on hard woods, the maximum quantity.

Following these tests in the large cylinder, tests were made in the experimental cylinder on the Rueping process in the treatment of mixed oak and pine ties with straight asphaltic oil. The absorption obtained in the limited number of tests made on the Rueping process were very satisfactory, as the same penetration was secured by a limited quantity of oil as was secured by a larger quantity of oil in the straight asphaltic oil pressure process. This experimental test merely proved the applicability of asphaltic oils for use on a large scale in the Rueping process, although it is readily admitted that there was no long-time practical tests to emphasize the theoretical deduction that the treatment would be a good one. It is also readily admitted that the only value of asphaltic oil, obtained from the central United States, as a wood preservative, would be in using a parallel treatment to that in which the Santa Fe railroad have

obtained such excellent results, viz., the injection of a maximum quantity of oil into the wood. The only object in citing the experiment on the Rueping process is to show that the asphaltic oils are at least applicable.

As the distillation data in Table No. 1 demonstrate that the fractions of asphaltic resudual oil possess high boiling points, comparing in this respect very favorably with good coal-tar creosote, and at the same time comparing favorably with the analysis of the Bakersfield oil, it seems reasonable to assume that it has great value as a wood preservative.

It has been claimed that if the asphaltic oils were injected in maximum quantities into the various species of red oak, beech, elm, gum, etc., the quantity which would be absorbed per tie would be so great that there could be no economy in its use. The attached data and the cross section samples taken from the ties in the several tests made on these species of wood with asphaltic residual oil prove that this is not the case. Good penetration has been secured by not over an eight-pound per cubic foot injection of asphaltic oil, which also proved to be the average amount the various timbers would absorb.

This proved the case with all except the short-leaf pine ties, and even with that species, the amount of oil necessary to secure a maximum injection was not found to be prohibitive from the standpoint of economy.

The Santa Fe railroad and the National Lines of Mexico have demonstrated by a practical test, under abnormal conditions of about nine years' duration, the value of asphaltic oils when injected into pine ties to refusal. Some of the ties which successfully withstood this test contained a small amount of oil, yet it was in all

TABLE NO. 4.

PENNSYLVANIA RAILROAD TEST AT MT. UNION, PA.

STRAIGHT ASPHALTIC OIL PROCESS (TIMBERASPHALT).

No. ties in Chge.	Species	Cu. ft. in ties	Condition	Total absorp. gals.	Absorption per cu. ft. lbs.	Absorption per cu. ft. gals.	Absorption per tie lbs.	Absorption per tie gals.
480	Mixed	1758	Seasoned	1870	8.38	1.06	30.7	3.89
486	Mixed	1792.6	Seasoned	1730	7.60	.96	28.0	3.56
517	M. Oak	1654.4	Seasoned	1930	9.19	1.16	29.4	3.73
CREOSOTE MIXTURE PROCESS (66 2-3 PER CENT TIMBERASPHALT, 33 1-3 PER CENT CREOSOTE).								
314	M. Oak Timber	1720	Seasoned	1920	8.79	1.11	8.17	1.12
511	B. B. & M.	1635.2	Seasoned	2040	9.83	1.24	31.5	3.99
547	M. Oak	1702.6	Seasoned	1810	8.37	1.06	26.1	3.3

RUEPING PROCESS (TIMBERASPHALT) (EXPERIMENTAL CYLINDER).

No. ties in Chge.	Species	Weight in Pounds Before treatment		After treatment		Gain	Penetration
3	M. Oak	Pine	125	Pine	140	15	2 in. to heart
	Pine	Pine	177	Pine	195	18	Good
		M. Oak	164	M. Oak	190	26	Good

TABLE NO. 5.

MT. UNION TEST ON TIMBERASPHALT—FOR PENNSYLVANIA RAILROAD.

WEIGHT OF TIES BEFORE AND AFTER TREATMENT.

Species.	Before lbs.	After lbs.	Lbs. absorbed per tie	Gals. absorbed per tie	Lbs. per cu. ft.
—Run No. 915.—					
Hdwd. Special	212½	224	11.5	1.46	3.48
Sap Pine	210	234	24.0	3.045	7.27
Sap Pine	146	156	10.0	1.269	3.00
Seasoned L. L. Pine	180	211½	31.5	4.00	9.54
Birch	149	157	8.0	1.015	2.42
Gum	134	164	30.0	3.807	9.1
Red Oak	163	191½	28.5	3.61	8.66
Beech	180	198	18.0	2.284	5.45
—Run No. 916.—					
Seasoned Elm	148	178	30.0	3.807	9.1
Seasoned Birch	163	178	15.0	1.903	4.53
Seasoned S. Elm	168	221	53.0	6.72	16.06
Seasoned Gum	196	247	51.0	6.4	15.45
Seasoned M. Oak	136	152	16.0	2.03	4.83
Seasoned Pa. Pine	103	135	32.0	4.06	9.7
Green Y. Pine	125	152	27.0	3.42	8.18
Hdwd. Special	212	230	18.0	2.2	5.45
Seasoned Beech	189	220	31.0	3.93	9.4

cases the maximum quantity which the ties would absorb.

The foregoing data are the result of observations and experiments extending over several years with the asphaltic base oil to be found in such immense quantities throughout the central part of the United States.

Water Rates in Municipal Plants

By Leonard Metcalf, M. Am. Soc. C. E., Boston, Mass.

IN a paper before the Pennsylvania Water Works Association, Leonard Metcalf makes a study of the financial statistics of municipal water works which are given in the report of the U. S. Census Bureau on "Statistics of Cities Having a Population of Over 30,000" for the year 1907. The conclusions which he draws are given as they are briefly and clearly stated and show the average condition of municipally owned water works, notwithstanding the numerous details which are insufficiently reported or are not in shape to be compared accurately. —[EDITOR.]

Under the prevailing rates the public water works in this country have gross actual incomes (without allowances in the majority of cases, for water used for municipal purposes) of approximately

$2.58 per capita of population,
$1,800 per mile of pipe,
$71 per million gallons of water supplied,

and operating and maintenance expenses (including allowance for taxes, but excluding allowances for depreciation, fixed charges, and profit) of

$1.52 per capita of population,
$1,100 per mile of pipe,
$41 per million gallons of water supplied,

corresponding to

61% of gross actual income,

and net annual income of approximately

$1.06 per capita of population,
$700 per mile of pipe,
$30 per million gallons of water supplied,
39% of gross actual income.

The question arises, is this so-called net income sufficient to provide a reasonable allowance for depreciation and for fixed charges? Let us see.

The Government statistics of "net cost of system" and "present value of system" are admittedly neither reliable nor comparable, as reported for the different cities, and obviously the "outstanding debt" is of no significance except as indicating the extent to which past generations have contributed to the liquidation of the water works debt, and thus have been taxed for the benefit of the present and future generations. Moreover, for our purposes here the Government's method of computing the interest is unsatisfactory, as it involves the relative credit of the several cities and the probably erroneous estimate of present value of the works. Therefore we are forced to base our conclusions upon certain assumptions.

If we assume a "per capita value of the works" of $25, an annual depreciation allowance of 1% based upon value, not upon reproduction cost of the works, and fixed charges of 4%, corresponding to the best credit conditions, we should require

		Per Capita.
Depreciation....	1% of $25=	$0.25
Fixed Charges...	4% of $25=	1.00
Total		$1.25

If we assume a per capita value of works of $50, an annual depreciation allowance of 2% of the value of the works, fixed charges of 4%, we should require for

		Per Capita.
Depreciation....	2% of $50=	$1.00
Fixed Charges...	4% of $50=	2.00
Total		$3.00

or if we assume, as reasonable for average conditions, a per capita value of $35, a depreciation allowance of 1% (based upon the value not the reproduction cost of the works), and fixed charges corresponding to city conditions of 4%, we should require for

		Per Capita.
Depreciation....	1% of $35=	$0.35
Fixed Charges...	4% of $35=	1.40
Total		$1.75

As against these depreciation and fixed charge requirements we have seen

above that the Government report indicates an average net income, applicable to these uses, of approximately $1.06 per capita of population.

Broadly speaking, therefore, it appears that the net income of our public water supplies, upon prevailing rates and existing methods of supplying free water for municipal uses, is not sufficient to meet a proper depreciation allowance and fixed charges corresponding to the value of these works. Obviously no water company could do business upon such a basis. Moreover the rate (4%) upon which the fixed charges have been figured, is entirely inadequate for such works, if privately owned.

I do no appear before you as an exponent either of municipal or of private ownership of water works. Whether the present method of operating those public works is desirable, or not, is not at issue here, nor whether it is wiser to pay the cost of public water service by charging higher rates for domestic and manufacturing service than by direct tax for water used for municipal purposes, nor yet whether it is desirable, in the interest of a conservative public policy and to assist the city to meet such possible emergencies as conflagration or earthquake, to charge off the water debt at a more rapid rate than depreciation requirements alone would make necessary.

The significant point which I desire to call to your attention is one well known to you already—that it is not safe to compare water rates found in different cities, without full knowledge of all existing conditions, including the value of the works and the character of the service rendered. Therefore if the attempt is made to compare your water rates directly with those charged in neighboring cities, you should inquire immediately what the conditions of operation and allowances for depreciation and fixed charges may be, or in other words the financial policy in the operation of these works is.

Were you in the position implied by the Government statistics, with an average net annual income of $1.06 per capita, applicable to depreciation, fixed charges and profit, you might well find yourself with an annual deficit of between $1.25 and $1.75 per capita, derived as follows:

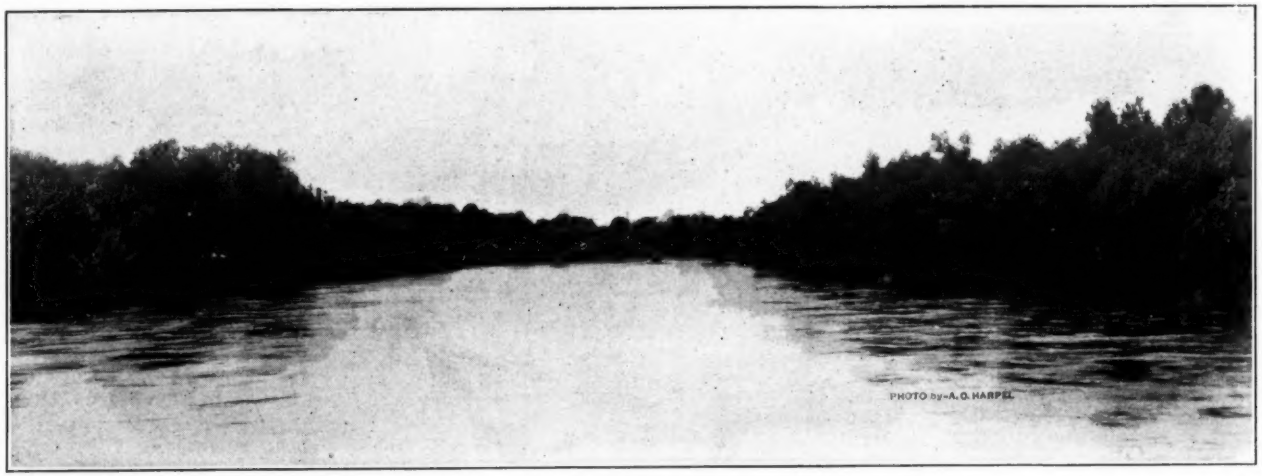
Average Per Capita Net Income, applicable to Depreciation, Fixed Charges and Profit (as per U. S. Government Report)		$1.06
Depreciation. 1¼% on $35=		$0.43
Fixed Charges 5 % on $35=		1.75
Profit..... 1¼% on $35=		0.52
Total	$2.70	2.70
Deficit Per Capita.....		$1.64

While these figures are only approximate, as the operating cost under private ownership is probably considerably less than that shown for public ownership, they serve to bring home the lesson to be drawn from these Government statistics, which has already been pointed out—that water rates cannot be compared equitably at their face value, without due allowance for difference in value of the works, character of service rendered, and any other important factors; and they show that upon the Government's average figures for gross and net annual income for municipal water works, under prevailing rates, these works are not earning a reasonable depreciation allowance and fixed charges corresponding to the probable present value of these works, under prevailing rates, and that private works or corporations could not earn a reasonable return upon the value of their plants upon water rates yielding such an average net income as that reported by the Government.

Des Moines River Improvements

THE situation of the city of Des Moines on the banks of the Raccoon and the Des Moines rivers might, perhaps, be considered as unfortunate as regards traffic and sanitary conditions; but a more ideal condition for the application of the principle of civic adornment would be hard to conceive. That this condition has been appreciated and taken advantage of, is evident from the river improvements which have been made up to the present time.

The first attempts towards the beautifying of the river banks were made about 1901, when retaining walls were built along some of the river shore. With the change in city government



I. DES MOINES RIVER, LOOKING WEST FROM MUNICIPAL BATH HOUSE.

and the adoption of the "Des Moines Plan of Government," a more systematic plan of improvement was adopted and is being worked out as rapidly as the legal tax rate and other conditions will allow.

In 1909 contracts aggregating $75,000 were awarded for river front improvement work. These were the first of a series which, if completed as planned, will bring the cost of the work to over one-half million dollars. This work is to be preliminary to the establishment of a civic center, and the development of a riverside park and boulevard system. The first photograph indicates the character of the natural river scenery along which these boulevards would run.

The second photograph shows the present condition of the river front at the point where it is proposed to establish the civic center. The number of spider-like truss bridges, the haphazard placing of the buildings, and the unkempt condition of the river bank are all very much according to the accepted condition of things in those cities so situated with reference to rivers. Contrast this with the third photograph, which shows the proposed civic center, with its parkways, boulevards and bridges all consistent with the plans for future adornment.

The Locust street bridge, which was completed in 1909, is an example of the type of bridge that will probably be adopted for all the structures within the limits of the proposed improvements. This bridge is of reinforced concrete, 66 feet wide and 502 feet long. The hand rails and copings are finished with a mixture of Portland cement and limestone screenings; the spandrel walls with cement and reddish brown granite; and the ends of the arch rings with cement and grey quartz. The surface was rubbed so as to bring the colored stones into prominence, giving a very pleasing appearance to the structure. In the background of the photograph may be seen the City Library, and new Government Postoffice buildings. Their appearance is no doubt much better as seen across this bridge than across the structure at the extreme left of the photograph.

The last two photographs are scenes in the Des Moines public parks, of which the city has about fifteen. Municipal bath houses and bathing beaches will be given much consideration in the development of the park system.

We are indebted to J. W. Hawke, city auditor, and Chas. W. Schramm, superintendent of the department of accounts and finance, for the accompanying photographs.

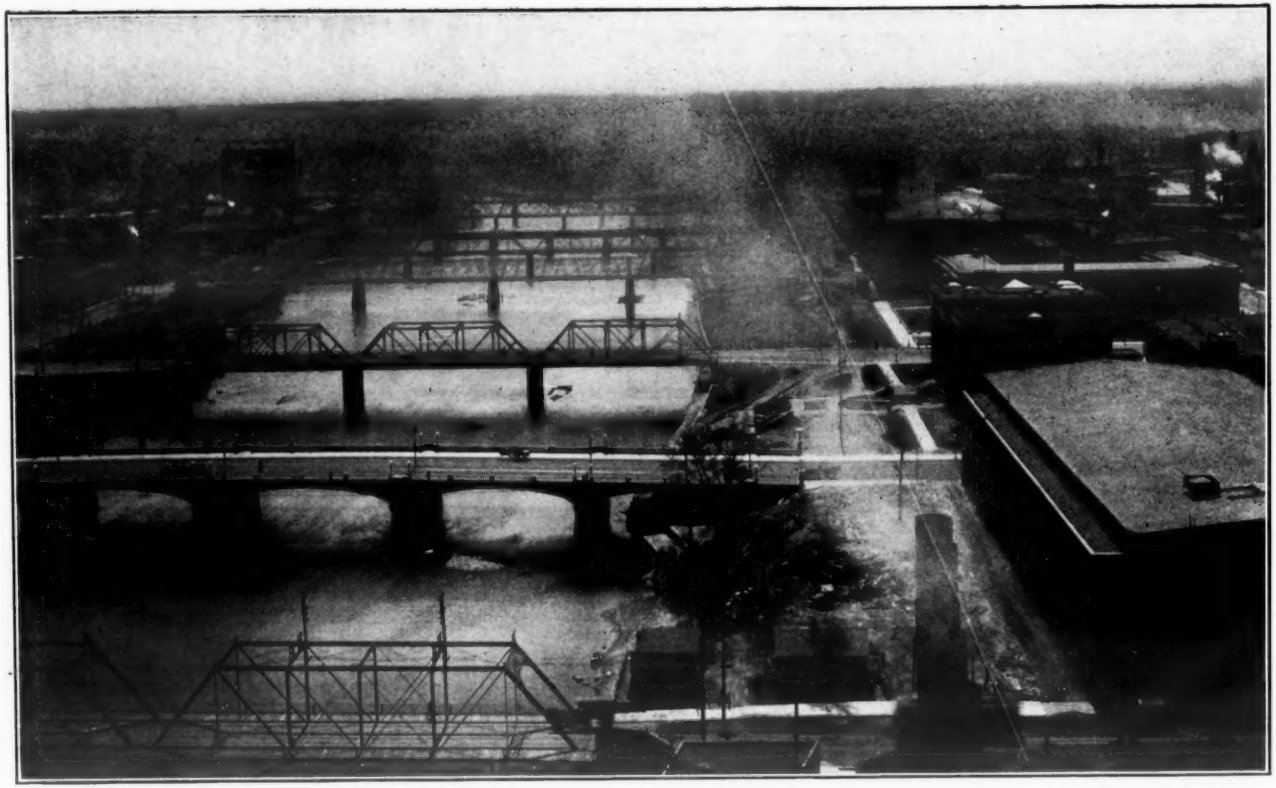
Garbage and Refuse Collection and Disposal*

By Charles Carroll Brown, M. Am. Soc. C. E., Consulting Engineer, Indianapolis, Ind.

BUT recently has it been recognized that garbage and refuse collection and disposal is an engineering question, which requires the best of study of men who have become familiar with the conditions by close observation and experience. It has long been considered a sanitary matter, and as such has been referred to the Health Officer or Board of Health for attention, all the other city departments passing it by as a vexing problem with no apparent method of solution. The Board of Health have been too apt to consider it in the same way, and to accept the labor of taking care of the city's wastes only because it is forced upon them and they cannot shirk, at least in words, something which all unite in declaring to be a matter concerning the public health.

As a consequence of this neglect of the question, and refusal to give it serious scientific study, opportunity has been given for others to exploit the city in one way or another and, by playing upon the ignorance of the city officials, to make considerable profit out of that ignorance. This attempt has been made by some who are equally ignorant and have therefore failed in realizing their expectations, as well as by those who have succeeded because of greater knowledge. It has also been made both with and without success by those who are trying honestly to do their communities a service. It has also allowed many experi-

*A paper before the Indiana Engineering Society.



II. SITE OF PROPOSED CIVIC CENTER.

menters to develop their plans at the public expense, leaving the said experimenters to reap the benefits when their systems have been fully developed. Few, if any, of these experimenters have attacked the problem of garbage and refuse collection, and few have attacked the whole problem of disposal of all the garbage and refuse of the city. The very important matter of the collection has been left almost to accident for its development. The result of all this neglect is a different method of collection in every city, almost as many methods of disposal, and the development of customs and habits among the people and the city officials which make any change looking toward uniformity very difficult to make. Conditions vary so much that all cities cannot be expected to follow exactly the same methods of collection and disposal, but the number of methods in use should be reduced to the few which have been and may be scientifically designed and will properly meet the demands of the local conditions in an economical manner.

The problem as a whole is to collect and dispose of the following classes of city refuse, more or less of each class being found in every city of sufficient size to make individual care for the waste matters of the inhabitants difficult, and the creation of nuisance too great to be permissible a probability.

The sewage of the city, collected through a sewer system, has long been considered a subject of expert engineering study, and will not be considered here, except to suggest that in some cases the sludge from disposal plants may be disposed of in connection with some other city wastes.

Garbage, in the strictest sense of the term, is the animal and vegetable refuse which attends the preparation of food for consumption. Garbage may be divided into two classes for convenience in discussing methods of collection and disposal, viz:

Household garbage is that produced by households separately, is generally small in amount in a single house and may not require removal, so far as quantity is concerned, oftener than once or twice a week, or even less frequently.

Commercial garbage is that produced in large quantities by hotels, large boarding houses, flats, if the garbage from the whole collection of households is deposited together. It requires frequent removal, at least once each day, and often several times a day. This frequent removal prevents the fermentation which takes place if garbage is stored for any considerable length of time in the ordinary climate, and the freshness, amount and concentration in a few deposits makes such garbage valuable enough in many places to warrant calling it "commercial" as it is often a matter of commerce. This commercial garbage also includes the refuse and spoiled materials from markets, vegetable and fruit commission houses, groceries, meat, fish and fowl shops and slaughter houses, docks, etc. Some is valuable for feeding to hogs, and some is valuable for reduction to recover the valuable ingredients, such as oil or grease, fertilizer, etc.

Manure may in some cases be classed as garbage, but is so often collected and taken care of separately that it must be named as a separate class of the city's wastes.

Dead animals can scarcely be classed with the commercial garbage, and yet may be disposed of in the same plant. While the amount of such refuse is very irregular, it is sometimes a difficult problem and must receive separate consideration in making any plan for refuse collection and disposal. Small animals are often collected with garbage or find their way to the garbage disposal plant for treatment.

Ashes, except in cities with natural gas, have a larger tonnage than all the other refuse. They contain a considerable proportion of combustible matter, variable in different places and at different times. If cinders and clinker are also considered, being of like nature and origin, i. e., refuse from fires, this class of refuse may be separated into commercial refuse, the collection of which equals or exceeds in cost the returns that may be obtained from its disposal.

Street sweepings may form a separate class, which partakes of the nature of manure when the sweepings are by hand from paved streets with heavy traffic, or of the nature of ashes or other inorganic matter when the mud from unpaved streets is allowed to accumulate and is then cleaned off. It may consist of any mixtures between these two extremes.

Large volumes of refuse not belonging to any of these classes are collected in every city. These matters have classified themselves largely according to the possibilities of disposing of them as follows:

Combustible refuse consists of paper, wood, straw, excelsior, grass, tree-trimmings, cloth, mattresses, etc., collected

III. PERSPECTIVE OF PROPOSED CIVIC CENTER, DES MOINES RIVER FRONT.

from householders, and like materials, collected often in large volumes from mercantile and manufacturing establishments. That from the latter sources is ordinarily classed as commercial refuse and has quite a definite value. That from houses and small commercial establishments is too small in amount and too miscellaneous in character to have much, if any, commercial value.

Incombustible refuse includes such household waste as tin cans, bottles, broken crockery and glass, leather, metals, remains of building repairs, etc., besides occasional earth, brick, cement, mortar, etc., the result of more extensive building and repair. Some of this material is of considerable commercial value and is sold or given to the junk men who go about gathering it up, but much of it cannot be so disposed of and must be considered as one class of the city's wastes which must have consideration in a comprehensive plan for keeping the city clean.

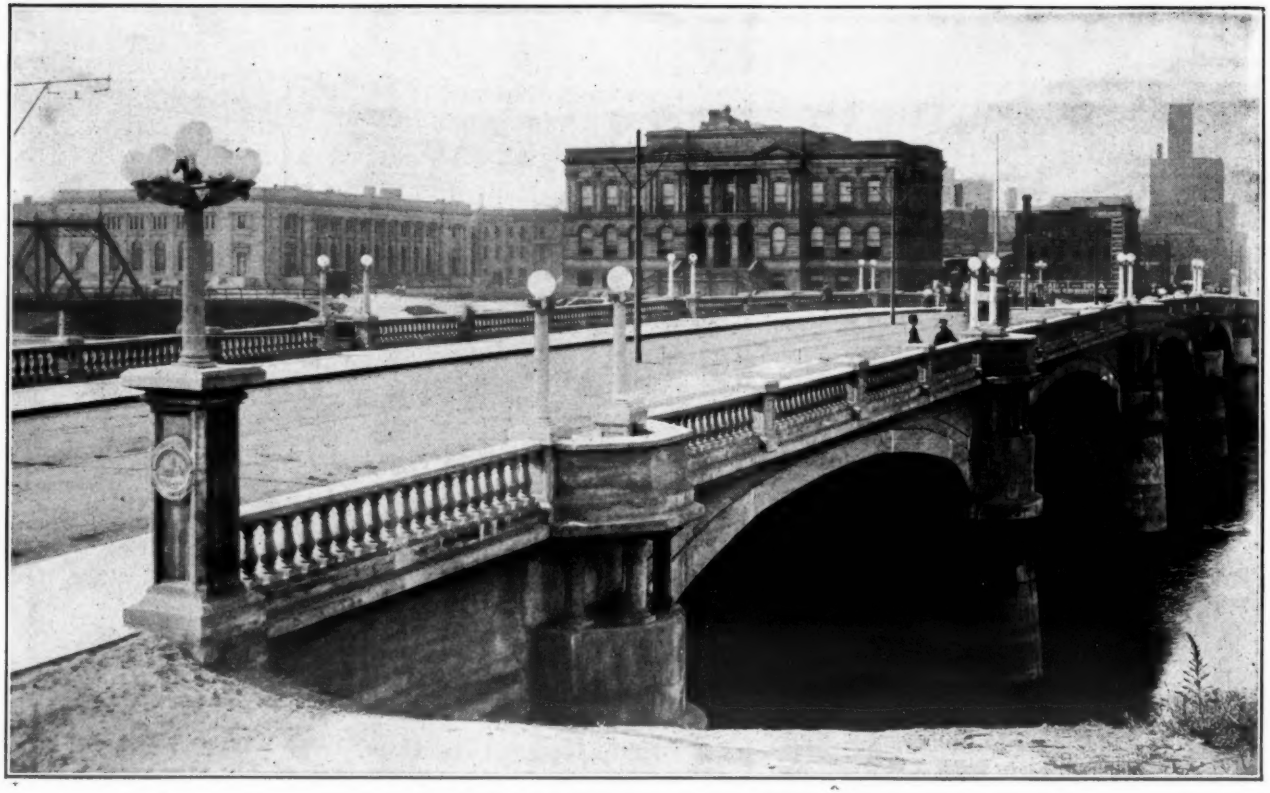
There is one class of city refuse which should not be permitted, but must be taken care of under existing circumstances in all cities to a greater or less extent. This is night-soil. A city with a complete municipal water and sewer system can enforce proper water and sewer connections and eliminate this matter. If water or sewers do not cover all the city there are districts in which deposits of night-soil now accumulate, and they must be taken care of until such time as they are eliminated by the extension of the water carriage system of removal or are prevented as suggested later.

As stated above, the collection of these wastes is a most important part of the problem and one which has been greatly neglected. If they are to be collected separately, the householders and others must be carefully instructed as to their separation and the kinds and sizes of receptacles to be used, the methods of storage and collection adopted, etc. This is a matter of sanitary importance, first and foremost, and when treated in the most sanitary manner is also treated in the most satisfactory manner, from the point of view of the collector who knows his business. The city department having most authority in such matters is the Board of Health, and it has been customary to intrust the supervision of the collection of refuse, or more particularly garbage and other organic refuse to that department. Unless a separate department is established, which has the fullest endorsement and co-operation of the sanitary authority, it is probably best to keep the collection in the hands of the Board of Health, whether the collection is made by contract or by the city's own forces.

It is very evident that if these various classes of waste are collected separately, they must be treated in quite different ways, if they are to be taken care of in the most economical as well as the most sanitary way. And it is equally evident that if any two or more classes of the refuse are collected together the method of disposal must be made to conform to the method of collection. Most of the failures in garbage and refuse disposal have come, not so much on account of the method of disposal or the apparatus used, as on account of the failure to suit the method of collection to the method of disposal adopted, so that the furnace or other process of destruction or utilization has been called upon to do work for which it was not intended and which it was unable to take care of satisfactorily. Any serious consideration of the disposal problem must therefore include a consideration of the collection problem.

There are so many local considerations which will modify any general plan that may be outlined, that the following will serve only as examples of methods of solution of the double problem, from which selections may be made, with the necessity in view of making these modifications; or which may serve as suggestions of the method of study of any problem which they do not happen to suit exactly.

Night-soil, as the most objectionable city refuse, is usually the first to be taken care of. In the smaller towns and cities without sewer systems, the earth-closet is the most sanitary manner of caring for such refuse, the polluted earth being used for fertilizer with success and without nuisance. Until the Board of Health can enforce the use of earth-closets in towns or in portions of cities not reached by water and sewer systems, the cess-pool collections must be removed by hand or by odorless excavators. This material is much more difficult to take care of, because it cannot be used so directly for fertilizer and is not so valuable as such. It can be buried if not put too deep nor in too large quantities in one place nor too thick a layer. Its discharge into any stream, even the largest, is little short of a crime. The mass cannot be satisfactorily treated in a septic tank, be-



IV. LOCUST STREET BRIDGE ON DES MOINES RIVER.

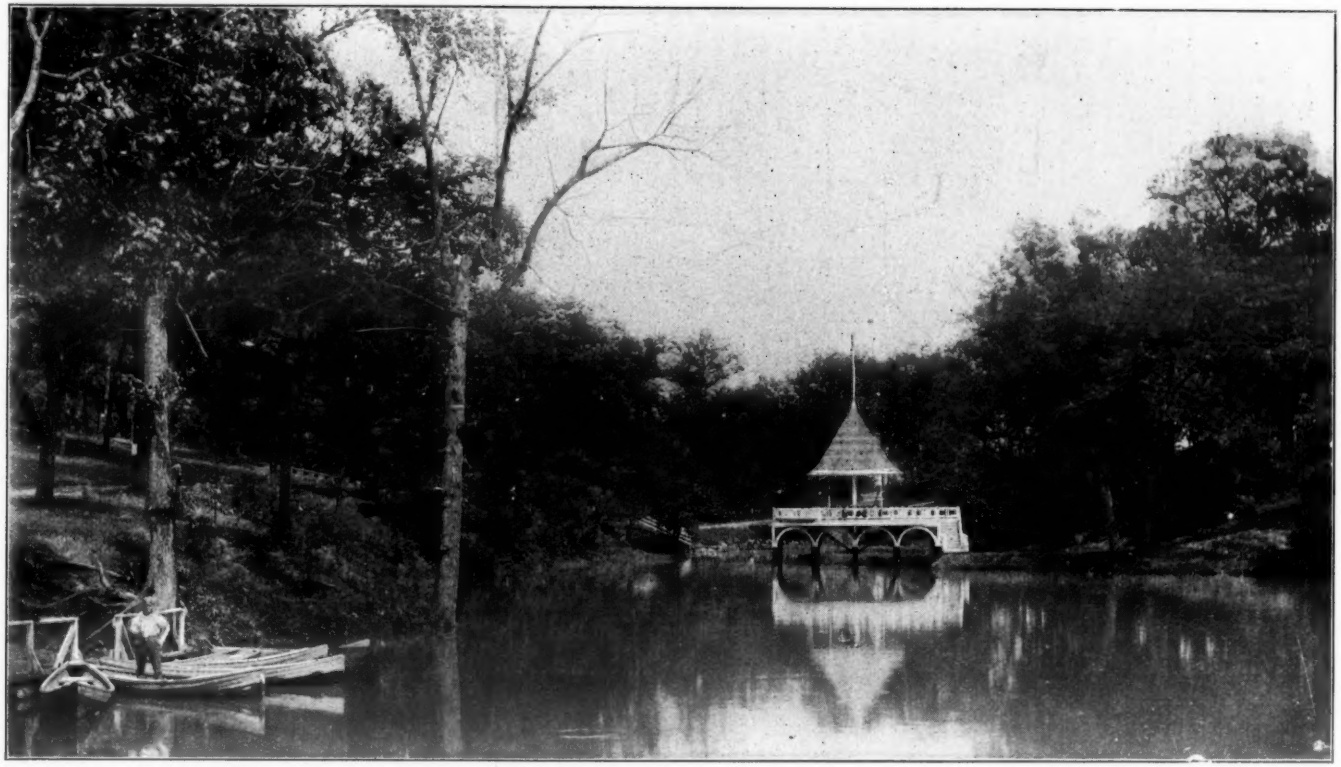
ing largely well past the septic tank stage and a mixture of sludge and matter which has not yet decomposed to the sludge condition. Possibly it might be handled in a sewage settling tank if sufficiently diluted, for example, by dumping it into a sewer with a good flow of water, in small quantities at a time. Night-soil is of course impossible in a garbage reduction plant, and can be taken care of in a destructor, incinerator or other form of furnace, whether using high or low temperatures, only in small proportion to the other matters burned and when properly mixed with them. The best treatment of this matter is to prevent its deposit, as already stated.

When householders keep hogs or other animals to which garbage can be fed, the problem of its disposal is solved. The fact that, when fresh, this is a valuable material for such purposes leads to the idea that garbage is too valuable to throw away and that its value must be extracted. This idea is correct, provided the cost of extracting the values is not greater than the financial return. What has been classed above as commercial garbage can be collected and fed to hogs before it is decomposed sufficiently to become objectionable as food or as producing odors in the neighborhood of the removal wagons or the feeding places. If the garbage can be collected often enough to keep it in the same condition it can be used in the same way. Unfortunately climatic conditions and the expense of collecting the usual small accumulations of household garbage daily cause either the objectionable decomposition with its attendant nuisance and deterioration in food value, or too great a bill for the labor of collection. Not all cities are in the fortunate position of Denver, which, on account of its climatic conditions is able to follow this plan and lets the contract for the collection and feeding of its garbage to hogs for a term of five years for the total cost of one dollar. In other words, the value of garbage as feed for hogs fully equals the cost of collection. The work is done under the close supervision of the Board of Health and is reported to be entirely sanitary both in collection and disposal. Los Angeles has been trying the same method lately with less satisfactory results, because the work is less thoroughly organized and the sanitary features are not properly taken care of. Some of the smaller eastern cities follow the same plan, but the writer without inspecting the hog-pens has always entertained doubts as to the condition of the hogs as well as of the freedom of the process from nuisance. Boards of Health are prone to close their eyes and noses when an improvement has been made, even if it does not produce all the results desired, if they see nothing better available for the money they have to spend.

The quality of garbage, from the point of view of the valuable matter in it, varies much in different cities and in different districts of the same city. In general it may be said that the reduction of garbage alone, for the purpose of saving the oil and using the tankage for making fertilizer, etc., is not profitable. Some of the commercial garbage may be sufficiently rich, but this is more valuable for feeding hogs and does not reach the reduction plant if it can be disposed of for hog-feed. There is, of course, no return from the incineration of garbage in the ordinary garbage furnace of any of the usual designs. On the contrary, it requires coal to complete the incineration of the garbage if not mixed with other refuse of a combustible nature, and there is therefore always an expense in the destruction of garbage in this way beyond the cost of the labor of collecting it and handling it at the plant. Some designers of furnaces refuse to construct them for the burning of garbage alone. It is surprising that American cities should not have discovered these facts earlier. They have wasted much money and made many failures trying to burn garbage, collected separately at considerable trouble and expense, when better results could have been obtained at less expense and trouble by change in the regulations governing separation and collection. The Health Officer of Minneapolis, for example, secures excellent results with considerable labor by householders, by requiring each bit of garbage to be drained over the kitchen sink and wrapped in paper before it is deposited in the garbage can. This mixes combustible refuse with the garbage and prevents freezing of the garbage to the can.

If dead animals are included with the garbage at a reduction plant, it is probable that the products will pay the expenses of the process of disposal, and quite possible that there will be a little profit to help pay the cost of collection. A well managed reduction plant for animals alone will make a profit, if all the items of value from hide to fertilizer base are taken into account.

Manure is said to have some value as a fertilizer, but the fact remains



V. A VIEW IN UNION PARK, DES MOINES, IOWA.

that many loads are disposed of by dumping in low places as filling material, and in some cities, more fastidious as to the material upon which future districts of the city shall be built, much manure is burned with other more and less combustible refuse in the destructors.

Ashes have considerable combustible material in them and may be used in helping burn other material. In England they have long been mixed with the other city refuse taken care of by the destructors and they seem to be needed to produce the most valuable clinker, which in that country seems to have some value. The cities of this country have had so many hollows to fill, in the process of preparing their areas for buildings, that ashes have been very convenient material and there has been little thought of their value for other purposes. They are possibly not of much value when mixed with wet garbage and refuse to pass through the usual incinerator, for the mixture does not remove the water which must be evaporated, but only conceals it and probably makes it more difficult to evaporate. The ashes seem to be desired in the high temperature destructors of the English pattern, partly because they make clinker out of the furnace ash, but the early reports from the new Milwaukee furnace indicate that the desired result is not as yet obtained there. If ashes are of greater value for other purposes than filling, the fact has not yet been demonstrated beyond doubt.

Street sweepings, as already stated, are of all compositions from almost straight horse-droppings to almost wholly inorganic matter, the result of the wear of the road materials. They are used indiscriminately for filling and there is little, if any, thought of separating the hand-sweepings of the down-town streets from the sweepings of the streets on to which mud is tracked from unpaved, sprinkled or muddy streets, or the cleaning of macadam streets. The fastidious cities referred to would do well to make this separation, running the more nearly complete collections through the garbage destructor before using them for filling. The remainder is very small, and the trouble from settlement in such filled areas is thereby greatly reduced.

Even in cities which burn their garbage it has been common custom to collect the combustible refuse separately from the garbage, partly because it is easier to drain the water from the straight garbage than to evaporate it from the mixture. The Minneapolis plan of wrapping the garbage in paper, however, makes it possible to collect the garbage and combustible refuse together and burn the mixture in the most economical way possible. If the city uses the reduction process it is necessary to collect the garbage separately, and it is then necessary to burn or otherwise dispose of the combustible and incombustible refuse. A few cities use the combustible refuse for filling along with ashes and incombustible refuse, but observation teaches that this custom means long continued settlement of the filled area and occasionally rather serious trouble from smoldering fires in the deposit. This material burns so well that it can be used in a furnace designed for it to produce steam or heat for other useful purposes, for which it is more valuable and much more suitable than it is for filling.

Incombustible refuse is so miscellaneous in its character that no general plan for its disposal can be made. What the junk men leave may be hauled to a dump, possibly passing on the way through a machine in which it can be picked over again by those willing to do so and to agree to stay by the job.

All sorts of combinations of these various wastes are made for the purpose of collection and disposal, most of them without any reference to the proper method of making the combinations or their suitability for the method of disposal selected. This, as stated, accounts for most of the failures in garbage disposal. This has in many cities given wrong habits to the citizens, which are in the way of the adoption of better methods and must be explained away before appropriations for the better methods can be obtained.

No attempt has been made to consider in detail proper methods of separation, collection and disposal, nor the furnaces, reduction plants or other apparatus or methods which produce the best results, for, as stated in the beginning, these methods and plants must be fitted to the work to be done, and to each other, and no one method can be applied to any great number of cities. If the nature of the problem has been stated definitely, and the importance of all the terms in it has been demonstrated, together with the necessity of considering all the parts in planning the collection and disposal of a city's wastes and thoroughly co-ordinating them, the purpose of this paper has been reached. Details of particular methods may be taken up at a later time.

VI. MUNICIPAL BATH HOUSE, DES MOINES, IOWA.

EDITORIAL COMMENT

Paving and Road Making—The Year to Come

PAVING AND ROAD MAKING.

Two notable conventions have been held in New York City during the past month, which, though presenting little that is new, should have much influence upon the development of the science of building streets and making and mending highways.

The first of these was the second convention of the Organization of City Officials for Standardizing Paving Specifications. This organization met last year at Chicago and adopted what it termed tentative specifications. This year it took up those specifications, made such revisions as seemed to be necessary after the hurried work of last year, such additions as were then foreshadowed, and a few corrections of mistakes.

The principal addition was that of the description of the standard rattler and the method of testing paving brick therein to the specifications for brick paving. A specification for bituminous filler and the method of applying it was also added, although the committee expressed its preference for cement filler. But little change was made in the wooden block specification, the claims of monopoly of the material specified being met by the counter claim that it can be purchased by any one in the market. No attempt was made, however, to answer the question, which was asked in the December and January numbers of MUNICIPAL ENGINEERING and again of the committee at the convention, and to give names of independent marketers of such products. The asphalt specifications received a few corrections, none of great importance. The bituminous concrete specification was entirely rewritten in accordance with the advancement in the knowledge of this form of pavement, and all suitable bituminous materials can now be used under the specification, the intention being to exclude only those which are admittedly unfit for the purpose. The macadam specification was made largely a local matter, and the stone block specification was not ready for presentation before the adjournment of the convention.

The second convention was one of the American Society of Civil Engineers under the direction of its Committee on Bituminous Materials for Road Construction, to which engineers and others not members of the society were invited. It was devoted almost entirely to the matters of construction and maintenance included under the title of the committee, but little concerning other materials and methods being presented. Little that is new was heard, but the exchange of experiences and the recital of difficulties should result in much good.

The need was clearly shown of standards for the determination of the quality of materials, and of more accurate knowledge of the properties which materials should have in order to produce good results, as well as of the proper combinations of materials, both chemical and physical. If the convention has added anything to the information for which the committee holding it is searching, or has given it any suggestions which will lead to study and experiment, and will save the committee the waste of time arising from duplication of the work of others, it will have justified itself.

Both the conventions seemed to be desirous of limiting discussion almost too closely. It is very easy to waste much time in profitless discussion and a tactful presiding officer is necessary unless strict rules are made and adhere to, but on the other hand the limitations may be too severe and so discourage the presentation of valuable information and suggestions but little

off the direct line and throwing most valuable side-lights upon the main discussion. There is also the danger of giving opportunity for the accusation that specific restrictions are made for ulterior purposes, especially if for any reason the strict rule may be broken at any one point.

The plan of organization of the city officials' convention transfers all the discussion concerning each class of specifications to the committee having that specification in charge. Some of the committees held open sessions to which any interested were admitted, and such as wished to enter into the discussion were given opportunity to be heard. The resulting specifications were also open to amendment on the floor of the convention, by direct invitation of the chairmen of the committees. These specifications seem to have been satisfactory to all. Other committees held closed sessions, but admitted each one who wished to make any statement to the committee, making such use of those statements as seemed good. One committee definitely announced to some of those wishing to appear before it that the committee would call before it those whom it wished to hear, and did not call some of those desiring to be heard. There is more or less dissatisfaction and even protest against the specifications prepared by those committees, and much doubt of the authenticity of some of the information given by one of them, owing to its indefinite character and, at least officially, unknown origin. Such management is not in keeping with the non-partisan, technical character of the proceedings of the organization as a whole.

Full discussion was invited by the president of the American Society of Civil Engineers of all subjects presented at the meetings to discuss bituminous and other materials for treating roads, but little was presented beyond official statements of methods in use by various eastern states and counties. Perhaps this was in part because of the discouragement of wide discussion by the secretary of the committee having the meeting in charge, but it seemed rather to be a lack of confidence in the efficiency of the methods presented and in those followed by some but not presented. The trail of the proprietary process was seen in this convention also, but not of the same nature nor to the same extent as in certain parts of the proceedings of the other convention. The general opinion seemed to be that one of these proprietary processes produces the best road obtainable with bituminous materials, and there seems to be a general effort to produce a road that will approach this as nearly as possible without infringement and without excessive cost.

The suggestions regarding duplication of work done by associations, heretofore made by MUNICIPAL ENGINEERING, are in line with the expressions heard on the floor of the city officials' convention, to the effect that organization will probably declare its work completed after another convention or two and may then turn the matter of revisions of paving specifications, as they may be needed from time to time, over to the corresponding committees of such a body as the American Society of Municipal Improvements.

The need of an organization of those interested in good roads which shall be independent and broad enough to cover the technical as well as the popular features of the road discussions, was shown by the evident desire of some of those at the roads convention to discuss other forms of road material than those to which the discussions were limited. The new American Association for Highway Improvement promises to be such an organization. It can take up phases of the question not coming well within the more purely technical field of the American Society of Civil Engineers, at the same time that it can sustain the dignity now conferred by that body, and will eliminate the unpleasantly commercial features in other good roads organizations. The devotion of so much time at the last two annual meetings of the American Society of Civil Engineers to the road question is most encouraging, but at the same time it was inevitable, for there are now so many engineers of standing sufficiently

high to give them membership in the society, who are now engaged in road construction and maintenance, that no other course was open. It is to be hoped that the next convention, under whatever auspices it may be held, will contain more men with the courage of their convictions and with information obtained by another year or so of experience, who will be willing to go into details more fully and discuss matters of cost and policy more freely.

THE YEAR TO COME.

This is the time of year when the engineer and the contractor are looking over the field and locating their probable fields of work in the coming season. Upon the possibilities of municipal work many of them depend, and, with some exceptions, such work depends but little upon general financial conditions. In fact, in bad times some cities do more work than in good times in order to give work to those out of their regular employment. So longs as bonds can be sold or special improvement taxes can be spread over a series of years this procedure is possible and the good work goes on. But this year reasonably good times are in prospect, and municipalities will proceed with their work on the usual lines.

The smaller cities and towns are rapidly taking up the improvement problems, and all cities, large and small, are emulating their neighbors not alone in the useful improvements but in those which beautify the city as well. As a consequence the municipal work in prospect is larger than in any preceding year.

Political changes have caused some to fear stagnation in business until the intentions of the new Congress have been shown, but the usual cry of "wolf" has not yet been heard, and it has been heard so often that its effect is now discounted by those who know from whom it comes and that those who issue it are themselves responsible for the commotion, if one arises.

A general view of the business situation, especially among manufacturers of machinery and materials of construction, indicates a generally hopeful tendency and a conservative preparation for increasing business.

Under these circumstances it has seemed proper to the management of MUNICIPAL ENGINEERING to prepare a special construction number to be issued on March 1, which will show in detail what the prospects are for work in 1911. The municipalities, the engineers, the contractors are already sending in their reports not only of the work in prospect for 1911 but also of the work completed in 1910 and that now in progress, so that full comparison can be made between the past year and the coming year.

These returns show large projects and thousands of small projects on the list for the ensuing year, and if they continue on the same scale as those already received will show more than a billion dollars worth of municipal improvements to be put under contract and much of it completed during the coming season. As this information comes in it is tabulated, condensed and summarized, and the results will be shown in the special number in detail. The contractors, in addition to their reports of work in sight, are sending in statements of the materials and machinery they will want in the near future and this is also collected and classified for the benefit of those whom the magazine is trying to serve. This, also, will be put in shape for publication in the March number in such form as to be of interest and value to all our readers.

The reports will be arranged under the various states for the cities from which they come, so as to be most conveniently available and will be valuable for reference for all the rest of the year.

Although this special information will necessitate a considerable enlargement of the magazine, a specially full table of contents has been arranged with special reference to the practical work of the engineer and the contractor, so that the number will be more than usually valuable from this point of view also.

Paving, sewers, sewage disposal,

street cleaning, water supply, garbage and refuse collection and disposal, street lighting, fire equipment, street signs, contractors' supplies and machinery, are all included, and combine to increase the size of the magazine again.

When to these increases are added those in the advertising pages, which also promise much of value and interest to our readers, it will be seen that the March number of MUNICIPAL ENGINEERING will be one of the most valuable single numbers of a municipal magazine which has ever been issued.

If any one has inadvertently been missed in the distribution of the blanks for reports he is requested to send for them at once that his city and his business may be properly represented in this inclusive number. The success of the information department depends upon those who supply it, and, while the response has been surprisingly prompt, it is difficult to reach every official in a city who can make a report, and every contractor; therefore, this request is made to all those who have not already received the blanks.

THE QUESTION DEPARTMENT

Periodicals in Water Works Field.

Our company desires to be up to date, hence wants to know the magazines published that deal especially with their line of business. It is a private company supplying artesian well water only.

W. R. R., ———, Pa.

All of the periodicals devoted to civil engineering pay more or less attention to the field of water works. There is no strictly technical publication known to the writer except the society journal named below, which devotes itself entirely to water supply subjects. From a list of periodicals published in MUNICIPAL ENGINEERING, vol. xxxiii, pp. 177 and 335, the following are selected as paying an appreciable amount of attention to the field.

Engineer, London, weekly, $10.

Engineering, London, weekly, $10.

Engineering Magazine, New York, monthly, $3.

Engineering News, New York, weekly, $5.

Engineering Record, New York, weekly, $3.

MUNICIPAL ENGINEERING, Indianapolis, Ind., monthly, $2.

Municipal Journal and Engineer, New York, weekly, $3.

Journal of the New England Water Works Association, Boston, quarterly, $3.

Fire and Water, New York, may be added as a trade journal.

MUNICIPAL ENGINEERING devotes its entire attention to the municipal field and believes it succeeds in covering the portion of the field occupied by our correspondent more completely than any of the others.

Location of Water Pipe in Street.

The contractor who is about to put a water main down the Grand Boulevard and Concourse has been granted a permit by me to place the water main under the sidewalk so as not to interfere with the roadbed. He now asks a change in the permit, whereby he may put the water main in the roadbed. I have stated to him that as the Grand Boulevard and Concourse is a wide road, intended for automobiles and pleasure traffic, it should not have its surface broken up continuously, as would be the case if the water main were in the roadbed, by excavating for house connections. Probably within the next few years a great deal of building will go on along the Concourse and every house must be connected with the water main. The design of our engineers, in ordering the water main put under the sidewalk, was to escape breaking up the roadbed.

Please let us know what your ideas are on the subject, and oblige,

CYRUS C. MILLER,
President of the Borough of the Bronx, New York City.

If but one water main is laid in the street there will be no reduction in the length of the cuts for making house connections, assuming each side of the street to be built up with approximately the same number of houses as the other; for all the houses on one side of the street would be obliged to cut entirely across the street to put in their connections. The saving of cutting into the street would therefore be only that of the water main itself. Evidently, under this condition it would be necessary for the city to pay for laying these house connections across the street, or an equivalent adjustment, otherwise property on

one side would pay more for its water connections than property on the other side. If two mains are laid, one on each side of the street, probably the ideal condition exists, especially if this main can be located near the property line, so that excavations for making connections can be made within the property line, with only such slight undercutting of the sidewalk (without disturbing its surface or foundation) as may be necessary to reach the main line and make the connection. Questions of assessment, distribution of cost, etc., may modify this best location.

It is sometimes difficult to locate a water pipe in a sidewalk because of the structures at the ends of the blocks, the depths of sewer connections, location of conduits and conduit connections to the houses, poles, if any, etc. The ordinary structures at the ends of blocks are catchbasins and inlets for sewers, lamp and street sign posts, letter box posts, telegraph and other poles, hydrants, and the like. One is astonished at his enumeration of these obstructions to travel and to underground locations the first time he stands on a street corner and counts those which he sees, and still more when he adds those which he cannot see and knows exist underground. Nevertheless, it is frequently possible to locate a water pipe line under a sidewalk in a fairly straight line.

It is sometimes proposed to locate such pipes in the lawns which usually exist on streets of the class named, but this is not always possible. The difficulty with locating sewer lines in this space is considered in the January number of MUNICIPAL ENGINEERING, p. 43. Water pipes would not have the trouble from tree roots there named, but repairs to breaks in the pipe, relaying with new or larger pipe and sometimes the making of house connections might interfere very seriously with the life of trees planted in these lawns. Also, the catchbasins for storm water are ordinarily located near the curb lines and, unless the lawn is wide enough or is located far enough back from the curb for the water pipe line to miss the catchbasins, very objectionable sudden double bends must be made around them.

It may be necessary in laying the water pipe anywhere between the curb and property lines to relay some sewer and conduit connections, but it ought to be possible, where the sewers and conduits and their connections have been laid according to proper rules and regulations, to lay the water pipe above the sewer connections and below the conduit connections and keep the pipe straight enough in the vertical plane as well as in the horizontal plane, and always below the frost line.

If the comparatively small increase in cost due to the difference in cost between the double main, one on each side of the street, and the house connections to a single main is not objectionable, the writer favors the main on each side of the street located between the curb and property lines in the most convenient place. It may readily cost a little more to lay the water main in the sidewalk space, on account of the obstructions named and the necessity of replacing some of them. But a street may also be crowded with underground structures which would make the location of the pipe there more expensive.

The consideration is general and the proper reply to the questions asked, for any particular street, could only be made after a careful study of the location of all the obstructions to be met with in that street and with some knowledge of the taxing and assessment powers of the authorities in case the property owners must pay the cost.

Information About Aqueducts and Engineers.

What sources of information are there on the laying of aqueducts to bring pure water to cities? Can you give me the addresses of engineers in the Central States who have had experience in this work?

C. D. O., Saginaw, Mich.

Books which treat on this subject among others in water supply engineering are Turneaure and Russell's "Public Water Supplies" ($5); Folwell's "Water Supply Engineering" ($4), a brief consideration.

Among articles in MUNICIPAL ENGINEERING which will be of interest in this connection the following may be specially mentioned:

In vol. xxxix: "Machine-Banded Continuous-Stave Wood Pipe," p. 13; "The New Gravity Water Supply for Pulaski, Va."; "The Municipal Water Works of Mattoon, Ill."

In vol. xxxviii: "Day Labor vs. Contract Work on Los Angeles Aqueduct," p. 425; "Plans for Concrete Conduit," p. 45, giving references to a number of previous articles.

Names of engineers competent to design and construct aqueducts can be procured from the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Civil Engineers," "Consulting Engineers," taking those named as making water supply a specialty.

Charges for Sprinklers and Standpipes for Fire Protection.

This city owns its water works. Of late a number of factories, storehouses and stores have put in systems of sprinklers and standpipes. Could you inform me what are the charges that cities of about 20,000 make for this protection? Some of our citizens think it should be free.

F. J. G., ———, Que.

Theoretically a municipal water works should receive for each service that it sup-

plies the full cost of the service. In a case such as that named, the value of this service cannot be measured by the amount of water used. The principal item of cost is the increase in size of supply and service mains necessary to furnish the water required for the new fire protection systems. Theoretically this should be very small, if anything, because the proper action of the sprinklers will obviate the necessity of using the fire hydrants, so that under perfect conditions even smaller supply mains might be required. Practically, however, it is possible for the connections to such sprinkler systems to draw so much water from the street mains in time of conflagration as to reduce the pressure at hydrants below the point of ability for service, unless the mains and the supply of water are increased to allow for the simultaneous action of the two draughts upon the water works. In any event, there are connections, valves, check-valves, meters, etc., to install, and there must be some small charge to cover their maintenance, operation, depreciation and interest. The amount of this charge cannot be fixed arbitrarily, but, in justice, should be determined by a study of the local conditions.

Standpipes, if used only to make it easier for the firemen to reach the upper stories of a building, through attachments of hose at their lower ends for supply and at their branches for the fire service, are apparently a convenience to the water works rather than an expense, and if these standpipes are installed by the owners of the buildings under municipal regulations it would seem quite proper to make no charge for them.

Such standpipes have no connection with the water mains except when it is made by the firemen, whereas the sprinkler systems are ordinarily in direct connection with them, so that water could be drawn from the system without detection unless careful inspections are made at frequent intervals. While such thefts of water are not usual, they are altogether too common, and the water department must admit the danger, and provide, in fixing the amount of its charges, for the expense of this inspection.

No opening of sufficient size to decrease the pressure in the mains materially, if left open, should be permitted, unless the service pipe has a gate valve far enough away from any building so that it can certainly be operated at any time, thus insuring that the waste can be cut off in case a conflagration should cause the fire service to run an open stream.

The fact that sprinkler systems reduce insurance rates from 30 to 50 per cent. should make the property owner willing to pay the full cost of maintaining the service and a reasonable additional allowance for unforeseen contingencies.

Charges are reported from various places of 5 to 12½ cents per sprinkler head, according to the number of square feet sprinkled, according to value of property protected, according to number and size of connections, etc., showing the entire lack of uniformity.

Following are some of the charges made in American cities for these services, showing still further that there is no definite principle of fixing them which is in general use:

Selma, Ala., municipal plant, charges $45 a year for private fire hydrants, 10 cents each for the first 100 sprinkler heads and 5 cents for each additional, with minimum of $100 a year with sealed fire connections, frequent inspections, and $5 forfeiture for every seal broken, unless in case of fire.

Atlanta, Ga., municipal plant, requires consumer to pay expense of all installations, connections, valves, meters, placing same, testing, etc., the city employes to do all work to property line and charge the same to the consumer.

Rome, Ga., municipal plant, furnishes fire protection free.

Kankakee, Ill., private plant, charges $300 a year minimum for fire protection, giving the privilege of using water to that amount at 10 cents per 1,000 gallons.

Terre Haute, Ind., private plant, requires meter set at expense of consumer, and a minimum rate of $20 to $25 a month, or $240 to $300 a year, whether the fire service has been drawn upon during the year or not.

Davenport, Ia., municipal plant, has similar provisions and sets a gate valve on the branch as near the street main as possible.

Lexington, Ky., permits no fire services of more than 2-inch pipe.

The Baltimore suburban plant, private company, charges for fire protection systems for 10-inch pipe, $1.25 a linear foot for laying and $150 a year; for 8-inch, 90 cents and $100; for 6-inch, 60 cents and $50; for 4-inch, 40 cents and $50, respectively. The company decides the size of pipe necessary.

Battle Creek, Mich., municipal plant, charges the following schedule of prices per year for fire services and other special uses: 8-inch pipe, $400; 6-inch, $200; 4-inch, $100; 3-inch, $75; 2-inch, $50; 1½-inch, $35; 1-inch, $20. Half the price for the first pipe will be charged for each additional pipe serving the same premises. The rules state that "the above rates are required in order that the burden of carrying a supply of water at high pressure, and under such difficulties as surreptitious uses, leaks, and danger of contamination of city water from tanks, wells, etc., as have been found to exist in a large number of water works, shall be carried by the people who have the advantage of lower insurance, better fire streams, and preparation for emergencies such as cannot be easily foreseen."

St. Paul, Minn., municipal plant, has a rate, where fire services are not equipped with meters, of $100 a year for the ordinary sprinkler service of not more than two 4-inch connections and $50 a year for each additional connection; $150 a year for existing 6-inch connections, not exceeeding two, and $75 for each additional; $300 a year for each 8-inch sprinkler connection; $1,000 a year for each 10 or 12-inch connection. The connections larger than 4-inch are to be dispensed with as rapidly as circumstances will permit. Meters can be ordered on connections at the discretion of the water board.

Hackensack, N. J., will provide a meter with a by-pass of full size of pipe, whose gate is sealed and opened only in case of fire, or will provide a connection without meter if it is independent of the regular supply and an agreement is made that the fire service is to be used only in time of fire, the charge to be one-half the regular minimum meter rate for the size of pipe used.

Elmira, N. Y., charges $75 a year for a 6-inch fire or sprinkler service, with the privilege of using water up to 1,000,000 gallons a year through such service; $50 for a 4-inch service, allowing use of 750,000 gallons a year; $35 for a 3-inch service, allowing use of 475,000 gallons a year; $25 for 2-inch service, allowing use of 400,000 gallons a year. These are in addition to the regular charges for water for general purposes, which must also be paid. Regulations are given below.

Jamestown, N. Y., municipal plant, furnishes fire service free, consumer paying all expense of making the connection.

Walkerville, Ont., private company, charged one plant about $100 a year for two 4-inch and two 5-inch fire service connections.

Catasauqua, Pa., charges $100 a year for sprinkler system on 3-inch metered connection in addition to charge for water used for all purposes.

Erie, Pa., municipal plant, furnishes one connection up to 6-inch size, laid to curb, for fire purposes only, without charge.

Wilkinsburg, Pa., private plant, requires detector meters installed and under its control, at expense of property owner, sealed outlets to the private fire system and immediate notice of breaking of any such seals.

Richmond, Va., municipal plant, charges $50 a year for each fire protection system with an agreement to use the water through such connections for no other purpose.

One private company reported to the American Water Works Association a contract with one consumer for fire protection service which was changed from 6 cents per 1,000 gallons with a minimum of $50 a month to a rate of 5 cents per 1,000 gallons with a minimum of $125 a month and a sealed unmetered valve which they had the right to open in case of fire.

Worcester, Mass.; Hartford, Conn.; Belmont, Mass., require meters on fire services; New Haven, Conn., reserves the right to put meters on fire services. Bridgeport, Conn., requires meters on fire services to be paid for by owner of property at actual cost.

Herewith are given the rates and regulations for private fire protection in a municipal plant and in a private plant, which may be taken as good practice in most respects and as about the ordinary practice in plants making no charge for the service and in plants attempting to charge what the service costs, with a reasonable addition for profit. These charges, or lack of charges, should not be accepted blindly for any other place, for local conditions may materially modify the amounts.

Atlanta, Ga., with a municipal plant, has the following rules, which have met the approval of the insurance rate makers of the Southeast, and of Atlanta:

Water for fire protection shall not be introduced into any premises without application of the property owner having been first made to the water works and granted officially.

Water for fire protection shall consist of the following systems and be governed by the rules and regulations as prescribed for each class of service:

Class 1. Combination domestic and fire hydrant service shall consist of a pipe-line with a meter on by-pass of suitable size for domestic service required. A valve of the same diameter as the pipe shall be placed on the line and be closed and sealed, so as to divert all water through the meter. This is the only class of fire service on which a tap will be allowed for domestic use. The seal on the closed valve is not to be broken only in the case of actual fire. When seal is broken the water department shall be notified in writing at once and the valve will be resealed by the department.

Class 2. Fire hydrant service shall consist of a pipe-line with fire hydrants on same, the fire hydrant to be of the same size hose thread and operating nut as the city hydrants. All hydrants to be closed and sealed, and opened only in case of actual fire. When seal is broken on any hydrant, the water department must be notified in writing at once, and the hydrants will be resealed by the department.

Class 3. Stand pipe service shall consist of a pipe-line with hose connections smaller than that of the standard 2½-inch hose as used by the city. All hose valves to be closed and sealed, and opened only in case of actual fire. When the seal is broken the water department shall be notified in writing at once and valves will be resealed by department.

Class 4. Automatic sprinkler service shall consist of a pipe-line equipped with all the necessary appliances, as required by the insurance companies, water to be supplied either direct to tank or a combination of both. Valve on by-pass to fill tank shall be closed and sealed. Seal to be broken only by an employe of the water department, who will fill tank and reseal valves, which will be done upon request at the water works office.

Class 5. Automatic sprinkler and fire

hydrant service combined shall consist of a pipe-line supplying both automatic sprinkler and fire hydrants. The rules governing Class 2 and Class 4 shall apply to this service.

Seals will not be required on Classes 2, 3, 4 and 5, when an improved detector meter is placed in the line.

All drain valves on any of the above classes of service are to be closed and sealed. When broken, the water office shall be notified in writing at once, when same will be resealed.

Water will not be turned into any fire service until the company making same has filled and signed a blank installation report furnished by the water department.

The above classes of fire service are for the protection and benefit of the property owner, for which the city does not receive compensation. When the seal on any of the above classes of services is found broken and the water department not notified of the same, the offending party shall be subject to a fine in the discretion of the board of water commissioners. Any abuse or illegal connection for the use of water through these services shall forfeit the right of such service for fire protection, and the board of water commissioners, in their discretion, have the power to require any such service provided with a meter, to be put in at any time as said board may in each case prescribe and to make any change or just and reasonable requirements as good service may from time to time require in each instance, either as to said meter or as to any other part of said appliances pertaining to the same.

The parties having connections used for fire protection can test their fire apparatus at any time under the following conditions:

1st. Notice to be given at the water office that such test is desired, when date and hour will be fixed when test can be made.

2d. When test of fire service is made by the duly authorized insurance representative or insurance inspector, no permit will be required to break the seals, but in each instance the water department shall be notified in writing at once, and the valve will be resealed by the department. This notice must be made by the insurance inspector or representative.

The expense of tapping mains, making connections, testing completed work, placing valves, meters, or any other protective device that the board of water commissioners may deem necessary to prevent the illegal use of water, must in all cases be borne by the owner of the property benefitted. All connections from the city mains to the property line must be made by the authorized employes of the water department, and all piping, valves, hydrants and connections to said fire service inspected and approved by the water department before the water is turned into said service.

The Elmira, N. Y., Water, Light and Railroad Company uses the following rules and regulations for private fire services, the rates for them being given above:

No private fire or sprinkler service will be run into a building or supplied with water unless water is used on the premises for general purposes.

Private fire or sprinkler services shall be entirely separate from the general supply or other services, and shall be used exclusively for the extinguishing of fires.

Private fire or sprinkler services shall be provided with an indicator post valve of a make and pattern to be approved by the said Elmira W., L. & R. Co., at the curb line, or at such other place as shall be agreed upon by said company.

Private fire or sprinkler services shall have a by-pass around the indicator post valve, or some other valve provided for the purpose and located at such place as the company may designate. This bypass to have a small water meter attached and placed in a suitable pit or other convenient place for reading and repairing it, and where it will be at all times accessible to the inspectors of the said company, for the purpose of testing the fire sprinkler service for leaks or improper use of water.

No tap or water connection shall be allowed on a private fire or sprinkler service for use except for extinguishing fire.

The agents or servants of the said company shall be permitted at all reasonable times to inspect the fire or sprinkler services, and all other water services or connections on the premises, and may, if it deem it necessary, put seals on any valve, hydrant or other outlet from the fire or sprinkler service.

Upon the discovery of any breach of these rules and regulations the said Elmira W., L. & R. Co. may terminate this agreement and permanently shut off the water from the private fire or sprinkler service, or may impose a fine of not over $100. And in case water is found to be running in the fire service, except when being used for extinguishing fires, the service will be shut off and remain off until proper repairs or alterations are made.

Private fire or sprinkler services, including valves, meters, etc., for controlling them, shall be put in at the expense of the property owner, and under the supervision of the Elmira W., L. & R. Co., who shall be supplied with complete maps and plans of the system.

And it is expressly understood and agreed that the said company shall not be held to guarantee the sufficiency of its water supply for fire protection in said building; and that said company shall not be liable for the failure of water through said private fire or sprinkler service, whether occasioned by the scarcity of water in its mains, lack of pressure from any causes, or the breaking of a valve, main or connection, or the shutting off of water for repairs, new connections, or for any other cause.

The Baltimore County Water and Electric Company of Baltimore County, Maryland, has some paragraphs in its contract which are important, as shown by experience. They read as follows:

Any fire protection system supplied with water from the company's service shall be supplied exclusively with such water, and no connection will be allowed with any other system drawing its supply from any other source, whereby the company's water may be contaminated by the failure to close valves, or leaking check valves, etc., and no auxiliary or secondary suction pipe to any underwriters' pump taking water from the harbor, streams or other source whatever will be permitted. Any fire protection system using water from the harbor, streams or other source whatever will be permitted. Any fire protection system using water from the harbor, streams or other source than the company's service shall be kept separate

from any such system supplied from the company's service.

All fire services shall be subject to inspection by the company from time to time, and the owner or tenant shall give the inspectors all reasonable facilities for making the inspections, and any information concerning the same that the inspector or the company may require. Care will always be taken that inspections will be made with as little inconvenience to the owner or occupant as possible.

The circumstances in one case are detailed in an article in MUNICIPAL ENGINEERING, vol. xxxiv, p. 344.

Books on Electrical Engineering.

Have you any price list of engineering publications? If not can you suggest any good list of such books? I have been requested to prepare order list for a small library of electrical engineering books.

M. BANKS, New York City.

A list of "Books for Engineers" was published in MUNICIPAL ENGINEERING, giving brief statement of character of book, and prices. It appeared in several numbers between April, 1907, and January, 1908. The list of books on electrical subjects includes those on "Dynamo Electric Machinery" in vol. xxxii, p. 382, continued in vol. xxxiii, p. 14; "Miscellaneous Applications of Electricity," p. 16; "Electricity and Electrical Measurements," p. 16; "Electric Lighting and Distribution," p. 18, continued on p. 96.

To these lists may be added the following:

Parshall, Horace F., and Hobart, Henry M. Electric Machine Design. A revised and enlarged edition of their "Electric Generators." $12.50.

Branch, Joseph G. Electric Wiring. $2.

Hobart, H. M. Electricity. A book for engineering students.

Cramp, William. Continuous Current Machine Design. $2.50.

Hobart, H. M. Electric trains. $2.50.

Dawson, P. Electric Traction on Railways. $9.

Manufacturers of Electric Rock Drills.

On page 470 of the December issue of your magazine, we note you request additions to lists of manufacturers of "Electric Rock Drills," and would ask you to refer party interested to the "Denver Rock Drill & Machinery Co., Eighteenth and Blake streets, Denver, Colorado.

H. W. CLARK CO., Mattoon, Ill.

Small Cities with Commission Form of Government.

Will you kindly give me a list of cities of our size, about 4,600 people, which have put into practice the commission form of government?

P. G. ELLIS,
City Attorney, Durango, Cal.

Of 3 commission cities in California, Modesto; of 2 in Colorado, Grand Junction; the 2 in Idaho, Boise and Lewiston; of 19 in Kansas, Abilene, Coffeyville, Cherryvale, Caldwell, Girard, Independence, Marion, Neodesha, Wellington; the 1 in Mississippi, Hattiesburg; the 1 in New Mexico, Roswell; the 3 in North Dakota, Bismark, Mandan and Minot; of 10 in Oklahoma, Ardmore, Bartlesville, Duncan, Enid, Miami, McAlester, Sapulpa, Tulsa, Wagner; of 7 in South Dakota, Dell Rapids, Huron, Pierre, Rapid City, Vermilion, Yankton; of 5 in Tennessee, Bristol, Etowah, Richmond City; of 20 in Texas, Anthony, Corpus Christi, Kennedy, Lyford, Marble Falls, Port Lavaca; of the 2 in West Virginia, Bluefield; have populations not far from that of Durango, some being larger and some smaller. All of the following are much larger, viz.: 1 in Alabama, 7 in Iowa, 1 in Louisiana, 4 in Massachusetts, 1 in Michigan, 1 in Minnesota, 1 in Missouri, 1 in North Carolina, 1 in South Carolina, 1 in Washington, 1 in Wisconsin.

How to Find Area of Segment of Circle.

What is the "near rule" for determining (approximately) the area of a segment of a circle when you have no means at hand for determining the diameter of the circle of which the segment is a part? That is when you have only given the chord and the versed sine.

M. G. H., Memphis, Tenn.

The radius of the circle is obtained as follows:

Square the half of the chord;
Square the versed sine;
Add the two squares;
Divide the sum by twice the versed sine.
The result is the radius.

The length of the circular arc is obtained as follows:

Divide the versed sine by the chord;
In a table of circular areas giving the length of arc for each height, take out the length corresponding to the above quotient in the column of heights;
Multiply this length by the length of the chord;
The result is the length of the arc.

To find the area of the segment proceed as follows:

The area of the sector is equal to the product of the length of the arc by half the radius.

The area of the triangle between the two radii and the chord of the segment is obtained as follows:

From the square of the radius subtract the square of one-half the chord, extract the square root of the difference and multiply the result by one-half the chord. The product is the area of the triangle.

The area of the segment is obtained by subtracting the area of the triangle from the area of the sector.

Trautwine's "Engineers' Pocket-Book" ($5) gives a table of areas of circular segments when the diameter of the circle and the versed sine of the segment are known. To use the table find the radius as above, find the ratio of versed sine to diameter, enter the table with this and multiply the corresponding number by the square of the diameter.

Gas Processes and Rates.

(Continued from page 40)

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Light. Net.	Fuel. Gross.	Fuel. Net.
IOWA.						
Atlantic, Lowe	6.80‡	3.25	1.75	1.65	1.75	1.65
Centerville, Lowe	....	....	1.75	1.575	1.75	1.575
Charles City, Lowe	6.50	4	1.70	1.50	1.70	1.50
Cherokee, Tenney	6.80	3.03	....	1.50	....	1.50
Creston, coal	6.50	....	1.45	1.35	1.45	1.35
Fairfield, coal	4.55	....	....	1.55	....	1.55
Grinnell, Tenney	....	....	1.50	1.40	1.50	1.40
Iowa City, coal	6.00	....	1.30	1.25	1.30	1.25
Le Mars, Lowe	8.25	3.09	1.40	1.33	....	....
Oelwein, coal	4.55	....	1.50	1.40	1.50	1.40
Perry, Lowe	7.00‡	3.6	1.50	1.35	1.50	1.35
Red Oak, Lowe	6.90‡	3.25	1.75	1.65	1.75	1.65
Shenandoah, Lowe	6.15‡	2.45	1.75	1.58	1.75	1.58
Washington, Lowe	....	....	....	1.50	....	1.50
KANSAS.						
Emporia, coal	....	....	....	1.40	....	1.40
Winfield, coal	....	....	....	1.60	....	1.60
KENTUCKY.						
Danville, coal	3.06	....	1.25	1.125	1.25	1.00
Georgetown, oil	....	....	1.65	1.50	1.375	1.25
Maysville, coal	....	....	1.50	to		1.00
Paris, coal	2.50	....	1.60	1.50	1.35	1.25
Richmond, coal	2.25	....	1.50	1.25	1.50	1.25
LOUISIANA.						
Jennings, Beals oil	....	90†	1.50	1.35	1.50	1.35
MAINE.						
Bath, coal	....	....	....	1.50	....	1.50
Calais, coal	6.00	....	4.00	2.00	2.00	1.00
Rockland, coal	....	....	2.25	2.00	1.50	1.25
MARYLAND.						
Annapolis, coal	....	....	1.75	1.75	1.50	1.50
Cambridge, coal	4.00	....	1.65	1.50	1.65	1.50
Frostburg, Paul oil	....	....	....	1.00	....	....
Havre de Grace, Lowe	5.00	3	1.50	1.275	1.50	1.125
Salisbury, Lowe	5.25	2.85	1.40	1.25	1.40	1.25
MASSACHUSETTS.						
Amherst, Patton, oil	....	....	6.00	4.00	3.00	3.00
Athol, Lowe-Granger	5.98	4.9	2.00	1.75	2.00	1.45
East Hampton, coal	5.00	....	1.80	1.60	1.80	1.60
Greenfield, Lowe	6.60	3.4	2.00	....	2.00	....
Ipswich, Kendall, oil	....	3.3	2.00	2.00	2.00	2.00
Marblehead, coal	....	....	2.20	2.20	2.20	1.80
Middleboro, Patton, oil	....	3	3.50	....	2.75	....
Natick, coal	5.75	....	....	1.65	....	1.50
North Attleboro, coal	....	....	1.60	1.35	1.60	1.15
Norwood, coal	....	....	....	1.50	....	1.60
Plymouth, coal	....	....	2.00	1.90	2.00	1.50
Spencer, Lowe	5.70	4	1.80	1.60	1.80	1.40
Stoughtonfi naphtha, oil	....	....	5.50	4.95	5.50	4.95
Ware, coal	....	....	1.75	to		1.25
MICHIGAN.						
Albion, coal	3.10	....	1.50	1.20	1.50	1.00
Belding, coal	3.25	....	....	1.25	....	1.25
Big Rapids, Patton, oil	....	3.5	....	1.25	....	1.25
Cadillac, coal	3.35	....	1.15	1.00	1.15	1.00
Charlotte, coal and Lowe	3.05	....	1.35	1.25	1.35	1.25
Cheboygan, coal	3.25	....	1.40	1.26	1.40	1.26
Coldwater, coal	....	....	1.50	1.25	1.50	1.00
Dowagiac, coal	....	....	1.50	1.35	....	....
Grand Haven, coal	3.25	....	1.35	1.25	1.35	1.25
Greenville, coal	....	....	....	1.25	....	....
Hillsdale, coal	3.15	....	1.35	1.25	1.35	1.00
Ionia, coal	....	....	1.25	1.25	1.25	1.25
Iron Mountain, Lowe	6.00‡	3.4	1.50	1.35	1.50	1.35
Ludington, coal and Lowe	3.25‡	3	1.30	1.235	1.30	1.235
Marshall, coal and Lowe	5.10	....	1.50	1.35	1.50	1.00
Monroe, coal	2.95	3	1.20	1.10	1.20	1.10
Mt. Clemens, coal	3.25	3.65	1.15	1.00	1.15	1.00
Mt. Pleasant, coal	....	....	1.40	1.20	1.40	1.20
Niles, coal	2.95	....	1.25	1.19	1.00	0.95
Owosso, coal and Lowe	2.95	3	1.20	1.18	1.20	1.18
Three Rivers, coal	3.10	....	1.40	1.30	1.40	1.30
Ypsilanti, coal and Lowe	2.90	3.65	1.25	1.00	1.05	0.80
MINNESOTA.						
Albert Lea, Lowe	6.00‡	4	1.67	1.50	1.67	1.50
Austin, Lowe (Springer)	4.00	3.78	1.60	1.50	1.60	1.20
Faribault, Lowe	6.10‡	3.7	1.70	1.50	1.70	1.20
Rochester, coal	....	....	2.00	1.75	1.75	1.50
St. Cloud, coal	7.00‡	....	1.85	1.75	1.35	1.25

Information About Commission Form of City Government.

Will you kindly send me a notation of the articles you have had in past numbers of your magazine on the subject of the Commission Form of Government for cities and towns—especially, with reference to towns of our class—say, 5,000 people; and also any works accessible in any ordinary public library on the subject.

We are beginning to have the matter agitated here, and would like to become informed on the subject.

P. G. ELLIS,
City Attorney, Durango, Cal.

The January number and this number of MUNICIPAL ENGINEERING contain several articles on this subject, the following being in the January number:

"Comparison of Des Moines and Indianapolis Forms of Municipal Government," p. 8; "The Des Moines, Indianapolis and Boston Plans of City Government:" "Commission and Other Forms of City Government," p. 45, giving references to articles in vols. xxxix and xxxviii.

The following articles in vol. xxxvii may be of interest in this connection: "Self Government of Cities," p. 103; "Professional Mayors," p. 250; "The Latest Commission Form of City Government," p. 393; "Cities Adopting the Commission Form of Government," p. 399, giving a list of earlier articles on the subject.

Various volumes of the proceedings of the National Municipal League give papers on the various modifications of the original Galveston plan of municipal government as well as upon other successful forms. They can be obtained of the secretary, Clinton Rogers Woodruff, North American Building, Philadelphia, Pa.

Cost of Brick Paving.

Could you recommend any book where I could find some up to date cost data on the construction of brick pavement? Perhaps some of the back numbers of the MUNICIPAL ENGINEERING would be valuable in this matter. If so would you kindly refer me to the particular volumes. I have the National Paving Brick Manufacturers Association's specifications, etc.

H. M. S., Bryan, O.

Bakers "Roads and Pavements" ($5) and Gillette's "Hand-Book of Cost Data, ($5) contain information regarding cost of brick pavements. Their information must be used with care, for local conditions so vary that general figures or special figures for one case cannot be applied directly to any particular place, except by making the modifications required by the differences in conditions and in prices of material and labor.

MUNICIPAL ENGINEERING has a large amount of information on the subject. Reference may be made to the following articles:

In vol xxxix: "Brick Highways in Ohio," p. 182; "Cost of Brick Paving in Florida," p. 122; "Cost of Brick Paving with Granite Curb," p. 33.

In vol. xxxvii: "Cost of Pavements," p. 152; giving a collection of figures from various parts of the country; "Cost of Street Paving," p. 177, giving another collection of prices for which work has been let.

"Brick Street Paving in Columbus, O.," vol. xxxv, p. 141; "Brick Pavements in Paris, Ill.," vol. xxxiii, p. 160; "Paving in the Southwest," vol. xxxii, p. 32; "Some Points in Street Paving, vol. xxxii, p. 389; Paving bids in Knoxville, Tenn., vol. xxxi, p. 407; "Streets of Wilmington, Del.," vol. xzx, p. 7.

Reference to the department of "Improvement and Contracting News" under the heading "Paving" and the sub-heading "Contracts Awarded" since September, 1909, will add to the list of prices given in the articles given above.

Oiling Unpaved Streets of Small City.

I am superintendent of the light and water department and I wish to ask your Question Department regarding the sprinkling of streets with oil.

What is the best oil to use, and in what quantities must the oil be used to accomplish good results on different unpaved streets? We are agitating the question of oiling our streets in St. Peter and I wish some expert advice on this matter so I can take it up with the council intelligently.

It costs us about 12 cents per 1,000 gallons to pump our water, and we have to hire four teams during the hot weather for sprinkling, which costs $3.50 per day; and using about 5,000 gallons per day makes the cost per day about $14.60.

Now what I particularly wish to find out is, how many applications, and the approximate cost of each application for an area of about three miles of street. Our streets are unpaved and of a kind of limestone and clay mixture, making a very dusty street. I will appreciate it very much if you can and will give me some data and information on this subject.

W., ———, Minn.

Hubbard's "Dust Preventives and Road Binders" ($3) will probably answer all the questions our correspondent may wish to ask on this subject.

Mr. Hubbard states that oils with an asphaltic base must be used and that the preference is for residual oils, heavy enough to require that they be applied hot. The lighter oils may be used as dust preventives but they last a shorter time and do not serve as binder for the road material.

Macadam roads require 0.3 to 0.6 gallon of the lighter oils per square yard and earth roads 1.5 gallons or even more. The street described would require an intermediate amount, possibly not far from 1 gallon per square yard; the amount to be determined by experiment as to the amount of oil the road will absorb.

The cost depends on the cost of the oil and the expense of the outfit for sprinkling the oil and of storing and distributing the oil, as well as labor, and can hardly be stated, but would probably be not far from 4 to 6 cents per square yard per

application. The heavy oils would cost more, as the oil costs more and the special appliances for heating and distributing it, as well as the fuel, add to the cost.

A clay road is difficult to treat, being almost non-absorbent of the oil. It may be necessary to add sand if the limestone mixture has not taken its place. It will probably be found more economical as well as more satisfactory to harrow the oil into the body of the road, which has been shaped and ruts filled with a road machine.

Will our readers report their experience, taking care to include the data which will answer our correspondent's questions.

Book on Street Paving Laws.

I am under the impression that I saw advertised in MUNICIPAL ENGINEERING a book relating to street laws, mode of procedure for construction under the "Vrooman Act" and other ways. Would you kindly let me know the name of it and where it is to be gotten.

M., Ontario, Cal.

McCullough's "The Vrooman Act" ($2) was published a number of years ago by Edward Denny & Co., San Francisco, Cal. Whether it has been kept up to date is not known to the writer. The National Paving Brick Manufacturers' Association has published a pamphlet giving the forms necessary to follow in carrying through paving improvements in Illinois.

Can our readers give references to such books as asked for by our correspondent?

Baltimore Collects Its Own Garbage and Refuse.

In your December issue of 1910, there is a letter signed "S. D. C.," Cleveland, O., making inquiries in regard to list of municipalities operating their own garbage disposal plant, etc.

In your answer to his inquiry, you put Baltimore in the list of cities in which garbage is collected and reduced by contractors. I wish to correct this statement and say that the city of Baltimore has been collecting its own garbage and ashes for the last three years, and finds this system a big improvement over having it done by contractors.

J. L. W.,
Commissioner of Street Cleaning, Baltimore, Md.

Makers of Ice Plant Machinery.

Will you kindly inform me where I can get information and data on ice-making machinery.

J. D. M., Elko, Nev.

The makers of ice and refrigerating machines are the most prolific sources of information. There are about sixty of them listed in Hendricks' Directory. Among the leading manufacturers are the following: American Linde Refrigeration Co., 346 Broadway, New York; Baker Ice Machine Co., Omaha, Neb.; Buffalo Refrigerating Machine Co., 126 Liberty street, New York; Carbondale Machine Co., Carbondale, Pa.; Carolina Ice Machine Co., Charlotte, N. C.; Castle Refrigerating Machine Co., Indianapolis, Ind.; De la Vergne Machine Co., ft. E. 138th street, New York; Frick Co., Waynesboro, Pa.; Harris Ice Machine Works, Portland, Ore.; Morris & Co., Dallas, Tex.; Murray Iron Works Co., Burlington, Ia.; Newburgh Ice Machine and Engine Co., Newburgh, N. Y.; United Iron Works, Oakland, Cal.; United Iron Works Co., Springfield, Mo.; Vilter Manufacturing Co., Milwaukee, Wis.; Vulcan Iron Works, 604 Mission street, San Francisco, Cal.

Books on the subject are Wallis-Taylor's "Refrigeration and Ice Making" ($1.50), "Refrigerating and Ice Making Machinery" ($3), "Refrigeration and Cold Storage" ($4.50); Wakeman's "Refrigeration and Ice Making and Refrigerating Machinery" (25 cents); Redwood's "Ammonia Refrigeration" ($1); Ledoux's "Ice Making Machines" (50 cents); Leask's "Refrigerating Machinery" ($2); Dixon's "Ice Making and Refrigerating Machines" ($1).

Best Form of Municipal Charter.

As an interested reader of MUNICIPAL ENGINEERING, I presume to ask some questions.

How, where, when, and at what cost can I secure the best copies of methods of obtaining a charter, modern and up to date in its construction?

We are located in a fertile section with mineral and natural resources all about us, but we are a little city grown up on the side of the road, with blessings forced upon us, without any citizen endeavoring to modernize or adopt regulations in construction.

We own our own water plant, electric light and gas plants, and they were recently put under commission, but having been built one at a time, and without double units, they need renovation and condensing towards a greater efficiency and economy.

We need wide streets, established grades, sewerage, parks, paving, powers to condemn building laws, with powers to govern and regulate every improvement of a regulated city plan.

J. W. V., Cartersville, Ga.

The best method of obtaining a good, modern municipal charter is to form a committee of the best and most progressive citizens, who should call to their aid one or more of the experts in the country who have become familiar, by observation and experience, with the various forms of municipal government and the results thereof. Attorneys familiar with the constitution and laws of the state of Georgia should be members of the committee or in its employ.

After a careful study of the conditions this committee can probably prepare a document which will meet the requirements of the constitution and statutes at the same time that it gives the city and its officials the powers and duties necessary for the officials of a progressive city and

provides the checks upon the rapid movement and upon inefficiency and dishonesty which seem to be absolutely necessary.

It is the writer's observation that a charter prepared for one city will never suit exactly another city, even one in the same state. But if the constitution prohibits special legislation for single cities, the following of general plans has brought the cities under the provisions of the laws into sufficient conformity to make the application of uniform charters possible, modifications of details being usually possible to some extent within the terms of the law. If such a general law is required under the constitution, it may be necessary to secure the co-operation of other cities before the law can be passed.

After the form of charter is prepared by the committee and its advisers, there must be a campaign of education to secure the support necessary to press the passage of the law by the legislature. This campaign must be pushed into the other cities interested, in case a special law applying only to Cartersville is not possible.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Smokeless Firing in a City Boiler Plant.

It has been understood for some time by combustion engineers that the most effective way to solve the prob'em of smoke production with soft coal is by means of underfeeding and providing sufficient space in the furnace. The recent movement for the prevention of smoke in cities has led many people to an investigation of how best to accomplish this result who would otherwise not have understood the proposed methods upon which effective smokelessness are based.

The fallacy of attempt to provide smoke catchers or other devices intending to change smoke after it has formed into something else or to deposit it in various ways so that the escaping gas should be clean has been demonstrated many times. Smoke once formed cannot be suppressed and therefore those interested are now rapidly arriving at the unanimous opinion that the place to attack the smoke problem is in the furnace. This narrows the field of investigation down to a straight combustion prob'em, and the combustion engineers have proved conclusively that underfeeding of the coal, combined with proper air regulation nad sufficient volume for the burning of volatile hydro-carbons, are necessary requirements for success.

The experience of the superintendent of the State War and Navy Building in Washington, D. C., is an added instance of successful smoke prevention by this means. The problem was unusually aggravated in this case because of the size of the boiler plant in this building, which is probably the largest of the government buildings in Washington, and the fact that the smoke laws of the city are exceedingly rigid. The power plant consists of four 185-h.p. B. & W. boilers, two turbo-generator sets, hydraulic elevator service, and a combination of steam and hot water heating system. The boilers were originally hand-fired and it has always been considered necessary to burn hard coal under them in order to conform to the smoke ordinance. In order to work economy in operation it was decided to attempt the burning of soft coal by installing a trial underfeed stoker.

After this stoker has been installed a series of comparative tests on the stoker-fired boiler and on the hand-fired were run in order to get accurate figures on which to base a request for an appropriation from Congress to equip the remaining boilers with stokers. The results were conclusive. Not only did the stoker, which is of the Taylor gravity underfeed type, burn soft soal smokelessly at all loads, but it exaporated the same amount of water as the hand-fired boilers on 60 per cent. as much coal, while the efficiency was nearly 15 per cent. higher. The stoker furthermore demonstrated its ability to carry very heavy overloads continuously, and it was decided to attempt to carry the entire load of the bhilding on the one stoker-fired boiler. Accordingly the fires were pulled under the hand-fired boilers and the stoker-fired boiler has been carrying the load continuously ever since.

A careful comparison of coal burned showed that another stoker could be bought and would pay for itself without it being necessary to obtain any further appropriation. The coal being used on this stoker installation is New River run of mine, analyzing about 14,700 B. t. u. per pound, and with this coal a combined efficiency of approximately 80 per cent. is obtained.

In this case, the underfeed stoker which was installed primarily to solve the smoke problem has gone much further and changed the entire operating method of the station. This, of course, is possible because of the remarkable overload capacity of stokers of this type. The correlation of air and coal supply makes the stoker's capacity limited only by the capacity of the fan engine, which not only furnishes the forced draft but also operates the stoker mechanism. By means of the mechanical underfeeding, the coal is forced to pass up underneath the firebed, becoming gradually heated as it advances and distilling off the volatile matter before the fixed carbon reaches the temperature of combustion. The distilled gases then pass up through the incandescent fuel bed and are burned completely, thus obviating any chance of smoke being formed.

A Sewer Semi-Siphon.

One of the peculiar features in the new sewerage work at Louisville, Ky., has been the necessity for carrying various main sewers under Beargrass creek, which flows north through the eastern part of the city. One interesting device applied in the case of a 39-inch sewer is described in the report of the chief engineer, J. B. F. Breed, and Harrison P. Eddy, of Boston, consulting engineer.

This sewer passes below the south fork of Beargrass creek, the elevation of which is so low that the sewer cannot be built upon its normal grade. A special design for this crossing was, therefore, prepared. The structure consists of two 12-inch iron pipes carried under the creek, with the same invert grade as that of the sewer. In addition to these, there is provided a 36-inch iron pipe dipping down from the grade of the sewer beneath the bottom of the creek. This large pipe will act as an inverted siphon, but will not be put into use until the flow in the sewer exceeds the combined capacity of the two 12-inch pipes. At each end of this semi-siphon there is a concrete chamber, giving access to the sewer to facilitate cleaning when found to be necessary. There is also provided an emergency outlet into the creek, through which the sewage may be turned when the siphon is being cleaned or repaired. A sluice gate provided in the westerly chamber also makes it possible to shut off any back water from the Beargrass intercepter at such times. The three pipes are surrounded by concrete, the top of which will be coincident with the bottom of the invert channel of the creek when it is improved.

Specifications for Drilling Artesian Wells.

The following specifications for drilling 10-inch artesian wells at Jacksonville, Fla., were prepared by B. N. Ellis, superintendent of water works, to suit the local conditions and are found necessary to get good wells in that locality:

Well to be located in the city park, 150 feet west of prolongation of Pearl street and 100 feet south of prolongation of Third street; to be 10 inches in diameter and 980 feet in depth below the surface of the ground. Well to be cased with first quality standard wrought iron pipe, weighing not less than 35 pounds to the foot, to the rock below the sand and clay strata, about 500 feet; casing to be seated tight upon the rock so that there shall be no appearance of leak around the casing after the well is completed and shall have been shut up tight for 100 hours.

In sinking the casing it must not be driven hard enough to strain the threads in the pipe or couplings; if rock is encountered before the water bearing rock is reached an expanded reamer must be used to undercut the casing so as to enlarge the bore sufficient to allow the couplings to go through the rock. The bore of the well must be straight and full size so as to allow a piece of 8-inch pipe 4 feet in length to be lowered to the bottom of the well and pulled out again with ease. The top of the casing to be threaded so as to screw a flange on it and be left 2 feet below the surface of the ground. A flanged tee, valve and cap will be furnished by the board of trustees, and the contractor is to secure the same to the top of the casing. The contractor is to furnish all the necessary tools, casing, etc., for the sinking of the well, which is located close to Hogan's creek, into which the waste water is to be run. Care must be taken to prevent sand washing into the creek, also especial care must be taken not to injure roads, walks or shrubbery while erecting and removing machinery for the purpose of sinking the well. When the well is completed all the debris is to be removed and the ground left smooth and clean.

E. Ben Carter, superintendent of maintenance of way of the Florida East Coast Railway, in sending the above specifications also gives the following description of the method of handling contracts for railroad wells under the less definite conditions exisiting:

When I had our artesian wells driven at Mayport, East Mayport and Atlantic Beach I was entering upon then unknown "Chinaward" territory, and I made a combination contract and specification which read as follows:

"To drill an artesian well of 6 inches diameter at Mayport, Fla., the particular point to be designated by the railway company. To case out all loose material with approved iron casing of 6 inches in diameter so that the well can be closed with a valve without injury to the well (said valve to be furnished by the contractor without cost to the company), and to complete said well in every way in a workmanlike manner. * * * To furnish all casing, tools, machinery, transportation of men and material for the prosecution and completion of the said well at the contractor's expense. Contractor agrees to continue the drilling or boring of said well continuously day by day until a flow of water satisfactory to the party of the second part has been secured."

I could not be more definite in this case for the reason that it was untested soil. However, the well was drilled 630 feet deep and gave me a pressure at the ground of 22½ pounds. My idea in being indefinite was to be able to stop before reaching a flow, if at any time it was thought best to do so and put on pumps. The payment for this was $2.25 per foot, paid as follows: For each 100 feet of well drilled there was $1.00 per foot partial payment, and the balance of $1.25 per foot was paid upon the completion of the well in accordance with the agreement.

Monuments for Sewer Connections.

The city engineer and the chief sanitary inspector of Binghamton, N. Y., have devised a plan whereby the location of sewer connections may be readily determined.

Every year a considerable sum is expended by the city in seeking lot connections. The lot owner has paid for the connection in his sewer assessment, and if, when he attempts to use the sewer, he finds that the connection is missing, he does not search far, but applies to the city. Often it occurs that by excavating a foot or so either way the missing connection would have been discovered, but the city is called in and must stand the expense.

Under the proposed plan a marker similar to that used for water connections will be placed in front of every lot where the house is not connected with the sewer when the sewer is built.

This marker, which will cost in the neighborhood of $1.50, will be of iron, and will be charged up in the sewer tax against the lot owner. When the time arrives to connect with the sewer the marker is returned to the city and the owner reimbursed for the amount paid by him, the marker being used again in some other part of the municipality.

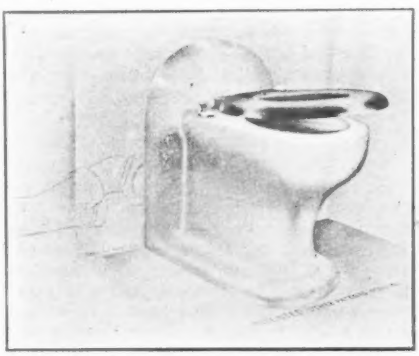
In this manner it may be possible to operate the sewer system with 200 markers, as all would be kept in constant use, and thus the expense of searching for lost sewer connections would be eliminated.

Appliances for Public Comfort Stations.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In connection with the presentation in your December number of a public sanitary for the city of Indianapolis, and one for the town of Brookline, designed by the writer, it has occurred to me that you might be interested to announce that the one in Brookline cost $8,000; also that the type of closet, not put in when the sanitary was built, as they were not on the market, but presently to be installed, is the "Keystone," cut of which accompanies. There is this difference, however, that those to be installed here have floor wastes while that in the sketch has a rear outlet.

You will, perhaps, be interested to learn that this closet was adopted for the new Pennsylvania Station in New York after most exhaustive tests by the



FOR PUBLIC COMFORT STATION.

architects and engineers; and from the fact that it offers very little opportunity for dirt and dust to collect about it, is superior to anything I have ever seen for general uses.

ALEXIS H. FRENCH,
Town Engineer, Brookline, Mass.

Specifications for a New Asphalt Pavement.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I was interested in reading Kingsley and Warren's controversy over pavements and I enclose cut and specifications of a new asphalt pavement we have been laying for the past two years in Rochester, N. Y.

H. T. POWELL.

Following are the city specifications for the new asphalt pavement.

The asphalt shall be composed of:
1. Asphalt Cement.
2. Sand.
3. Crushed Rock.

The asphalt cement and sand shall be of the kind and quality prescribed for use in the asphalt paving mixture.

The crushed rock shall be clean, freshly crushed, hard trap, granite, or other rock satisfactory to the engineer, of the following sizes:

Passing ¾-inch screen and retained on ⅛-inch screen.

Passing ⅛-inch screen to and including dust.

These materials shall be mixed to the following proportions:

¾-inch to ⅛-inch stone..20 to 30 per cent
⅛-inch stone to dust....30 to 40 per cent
Sand .....30 to 40 per cent

Asphalt Cement—Sufficient to thoroughly and satisfactorily coat all the particles and to produce a mixture containing between 8.5 and 10 per cent of Bitumen.

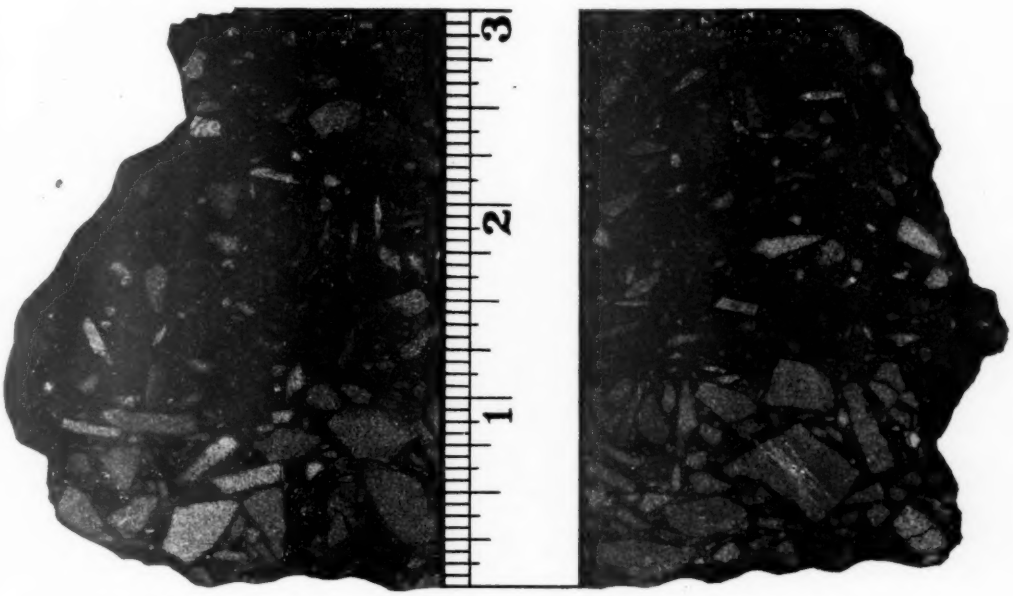
The above ingredients shall be mixed in the general manner prescribed for the asphalt paving mixture. The crushed rock and sand may be mixed cold and then passed through the heating drums where they shall be heated to a temperature not exceeding 400 degrees F. The mixture of crushed rock and sand when mixed with the asphalt cement shall be of such a temperature as will facilitate proper mixing, but in no case shall it exceed 350 degrees F. The asphalt cement shall be heated to about 300 degrees F., and the temperature of the finished mixture shall not exceed 340 degrees F.

The various ingredients shall be of such a kind and so proportioned as to produce a pavement which shall show upon analysis:

Bitumen ..... 8.5 to 10.5 per cent
Passing 80 mesh....20 to 30 per cent
(Of which at least 50 per cent shall pass a 200 mesh seive.)
Retained on 10 mesh.20 to 30 per cent

In all other respects the materials shall be manipulated and laid in accordance with the methods prescribed for the asphalt paving mixture. Should any segregation of the mixture occur during transit from plant to street, the material must be thoroughly mixed by shovels or other suitable appliances before being spread upon the street. The bottom inch is composed of larger stone flooded with No. 6 Distillate of Tar.

Pavements were laid in 1909 and 1910 of this improved mixture under city contract on the following streets: Plymouth avenue, Spring to Clarrissa; Monroe avenue, outside city line; Culver road, East avenue to University; Flower City Pike, Lake avenue to Dewey; Stillson street, University avenue to Grove; East avenue, Culver road to city line; Culver road, Monroe avenue to Canal; Winton road, East avenue to N. Y. C. R. R.; Dewey avenue, Augustine street to city line; Mt. Hope avenue, Comfort to Clarrissa.



Flushing Streets Under High Pressure.

Following is a report by W. A. Hogue, city engineer of Charleston, W. Va., to the board of affairs of that city:

Complying with your order of the 17th inst., wherein it is "ordered, That the question of flushing the streets and the question as to whether this manner of cleaning is injurious to the several kinds of paving used, to be referred to the city engineer for report, together with the literature now in the hands of the secretary, on the subject," I beg to report as follows:

I am pleased to note that the authorities are opposing the method of cleaning pavements by the use of water under high pressure from flushing machines or fire hose. The damage that necessarily will follow to all classes of pavements in the city by the use and continuance of this method of cleaning pavements is so obvious that it seems absurd for me to

dwell upon the subject at length; however, I desire to call your attention to some of the objections or reasons why this system should not be used.

Most of your pavements are brick, and it will be noticed in some sections of the city that after the flusher has passed over the pavement several times and the gutters clear of water, there can be found lying in the gutter clean sand and particles of brick. The fact is that the filler is being washed out, the edge of the brick exposed, subjecting them to a severer test from traffic or abrasion, with the result that they are gradually wearing away.

The same holds good to a large degree as to other classes of pavements. The continual wetting and washing takes the sand and fine materials from the composition, and it may be expected sooner or later to go to pieces.

There are other features pertaining to this subject which it might be well for you to consider. It is not an uncommon thing to see the pedestrians, ladies especially, having to rush to the inner side of the walks to avoid being splashed with mud and water, thrown upon the sidewalks by the flusher.

Again, the filth is washed into the catch basins, often times stopping them and causing the streets to be flooded, the sediment having to be removed at a greater cost than if taken from the street.

In conclusion, I would recommend "hand patrol" or "block system" of street cleaning through the day, supplemented by machine-broom cleaning at night, immediately preceding the machine-broom sweeping at night by a very light sprinkling (just enough to lay the dust, but not to convert it into mud). Such a system would be more sanitary and thorough, and keep the pavements in the best condition for use, overcoming the damage done to all classes of pavements by both machine flushing and excessive sprinkling.

Flushing Street Pavements with Water Under Pressure.

A good deal of trouble has arisen in some American cities as a result of flushing pavements with water under pressure, presumably too high a pressure, and it is stated that in some cases the contractors who laid the pavements are repudiating their guarantees on the ground that the pavements are not receiving fair treatment. We read of "the sand and soil" being driven from between the granite blocks, and of serious damage being done to "artificially constructed asphalt or bituminous surfaces." It is plain, of course, that the municipal engineer must suit the flushing to the pavement, and that there are some pavements which will stand much fiercer flushing than others. Nothing is to be gained by cutting up this truism into a number of platitudes, but we may look beyond to two important fundamental principles. The first principle is that if we want to push things sideways it is usually best to apply the force sideways. If we apply the force of moving water vertically by means of a flushing machine, "forcing water from about one foot above it, under pressure, on the surface of the pavement," as described by an American contemporary, we must be sure that the pavement and its joints are capable of diverting that water sideways without absorbing much of its energy with damage to themselves. In any case, water delivered vertically expends a part of its energy otherwise than in shifting the dirt, but it would be going too far to say that vertical delivery is never advantageous. The greater the damage, however, the greater the waste of energy. It seems that on the whole the best practice tends towards either of two types, the cart and broom type or the long hose type. By the former we mean pouring water on fairly copiously from a cart, and following up quickly with brooms before the water has had time to flow away; by the latter we mean the swilling down with a long hose, successfully done in London on asphalt pavements and on wood pavements with water-proof joints. If American city pavements will not stand either of these two methods, or methods of which these are the types, then the sooner those pavements are improved the better it will be for the purses and the health of the citizens. An important advantage of the long hose method is that the dirt is not driven hither and thither, but can be swept sideways by the jet, applied at a flat angle.

The other matter of principle is an economic one, namely, that the cost of flushing or other means of cleansing must be considered when one pavement is being compared with another as regards first cost and maintenance. If a fierce method of flushing is cheap in a particular city, compared with a gentle method, then the pavement that will stand it may be the cheapest, even if it is more costly on other counts than its competitors. In crowded cities we may have to consider also what method of flushing least obstructs the traffic, for delays to traffic may result in losses which are considerable, and as real as, if less tangible than, rates and taxes. The long and short of it all is that very large sums may be saved by securing the deliberate and carefully weighted opinion of a competent city engineer who, instead of being overburdened with routine office work, has time to stroll quietly about the streets, listen to the remarks of drivers of vehicles, watch boots and wheels, and get a vivid impression of what is going on. In these, as in other matters, it is a point of great importance that the city authorities should decide in good time whether they are going to depend upon the judgment of their own

engineer or whether a consulting engineer is to be called in; but a muddled idea as to the proper functions of different engineers is, unfortunately, an attribute of many civic bodies.—*The Surveyor and Municipal and County Engineer.*

Municipal Water Plant of Bradford, O.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I am enclosing the following information concerning the water plant that was completed and put in operation in our village, November 15, 1910.

In seeking a water supply four wells were sunk in various locations, but sufficient supply was not obtained. The fifth well drilled to a depth of 40 feet gave an abundant supply, and one near it, 116 feet deep, has been proved to be almost inexhaustible. Both wells give water of an excellent qaulity.

Five per cent. bonds to the amount of $25,000 were sold to provide for the water works, but after the work had been started, a number of changes in the plans made necessary an additional bond issue of $3,300.

The wells and pumping station are situated about 600 feet from the corporation line. From the station an 8-inch main leads to the standpipe; a cedar wood tank of 53,000 gallons' capacity, built on a 132-foot steel tower. Suitable valves and a Y-branch are provided to allow the standpipe to be cut off and a direct pressure supplied from the pumps in case of fire.

At the station two Cook working lead pumps raise the water from the two wells, which tap veins of water at different levels. A 22 gallon per minute pump operates the 40-foot well, and a 16 gallon per minute the 116-foot well. All of the pumps are operated by two 25 h.p. gasoline engines, only one engine being used at a time, and the other one held in reserve. About one gallon of gasoline is consumed for every horse power in 12 hours. Gasoline tanks of 50 gallons each are buried about 25 feet from the building. Engines are connected to a self-starting device of compressed air and can be started instantly.

A concrete reservoir of 50,000 gallons, located at the pumping station, provides a reserve supply. One Deming triplex power pump was installed to pump the water from the reserve reservoir into the mains. This pump has a capacity of 250,000 gallons in 24 hours. An air chamber has been provided at the pumping station which will, in event of failure of the standpipe, maintain the pressure for domestic consumption for a period of 24 hours.

There are 35 fire hydrants with two hose connections, conected with the 6 and 8-inch mains, six hydrants with one connection on the 4-in. mains. (Direct pressure from 80 to 120 pounds at hose nozzle for fire use.)

The total cost of the system was $28,300, which is itemized as follows:

Expense of advertising for letting contracts	$ 310.00
Engineer's services	2,179.14
Drilling wells	1,432.25
Water mains, 8, 6 and 4 inch	8,335.12
Pipe laying	3,715.42
Valves and hydrants	1,220.26
Standpipe	3,050.00
Reservoir and buildings	3,097.80
Machinery and pumps	3,723.15
Meters	260.60
Incidental expenses	976.26
Total	$28,300.00

Tony C. Heffel, Muncie, Ind., was the engineer in charge, and the contractors were the U. S. Pipe Company, Sullivan & Ryan, Bourbon Brass and Copper Company, Flint & Walling Company, A. R. Zimmerman, The Neptune Meter Company, and Fairbanks Morse Company.

A. P. LOWER, Mayor,
Bradford, O.

Use of the Recall.

A. L. Mason, of Indianapolis, contributes an article to the January number of MUNICIPAL ENGINEERING against the commission form of government, in which he has this to say about the recall: "Again, in several places where the recall is in use, as at Haverhill, Massachusetts, and at Los Angeles, the defeated candidate has used it to get another chance to win the office, by having a new trial. It is a dangerous instrument, unless," etc. Where does Mr. Mason get his facts, we ask, and is all the rest of his paper just as accurate as this? The recall has been used only twice in Los Angeles. In 1904 Davenport, a councilman who had voted to give the Times the city printing on a bid $15,000 higher than the other papers—a contemptible bit of graft—was defeated by A. D. Houghton, a newcomer to the city, unknown in politics, who had never before been a candidate for anything. There were no other competitors at this election. In 1909 Mayor Harper was recalled, that is to say, a petition was filed, and he resigned and refused to run. The man who won the election, George Alexander, the present mayor, had never been a candidate for mayor, nor for any other city office. The only other man running was on the Socialist ticket, and he had never been a candidate for mayor. That finishes the Los Angeles end of Mr. Mason's story. As for the Haverhill part, we recently read a detailed report of the working of the commission plan, and no mention was made of the use of the recall, which certainly would have been mentioned had it been used. We are not aware of a single case in any American city where the recall has been used as he describes.—*Pacific Outlook.*

MUNICIPAL MATTERS IN COURT

Higher Courts—Louisville Sewer Bond Case—Exclusive Privilege of Collecting Garbage—Right to Tax Gas Mains Sustained—What Constitutes Equipment

Decisions of the Higher Courts of Interest to Municipalities.

Report of Highway Commissioners—Sufficiency.—The variance between the preliminary report of the highway commission for the improvement of roads under St. 1907, c. 349, which stated that, where an asphaltic macadam pavement was to be made, it should be composed of a mixture of the best grade of hard, tough crushed stone, the best asphalt and other materials which would insure a pavement capable of sustaining heavy traffic, and the specifications for the work which allowed either gravel or crushed rock to be used in the composition of the asphaltic macadam at the option of the contractor, subject to requirements as to the quality and to the approval of the engineer of the commission, was not fatal to the contract for the work called for by the specifications.—City Street Improvement Co. v. Kroh, County Auditor (Cal.), 110 P. 933.

Special Assessments—Recovery of Surplus.—The law providing that any funds in the treasury of a city belonging to the fund of a local improvement district after the payment of the cost and expense of such improvement in excess of the sum required to defray the expenditures of the city on account thereof shall be refunded on demand, to the payers into such fund, and that no action to obtain any such refund shall be commenced until 90 days after such demand, in cases where the assessment roll is filed with the city treasurer for collection on or after the day such act takes effect, and not till six months after such demand, in "all cases where such assessment roll has heretofore been filed for collection," was intended to authorize such a recovery in all cases where there was such an excess from an assessment in the custody of the city at the time the act was enacted, though under prior acts an action for recovery thereof was barred.—State ex rel. McCullough v. City of Seattle (Wash.), 110 P. 1009.

Funds—Availability—Street Railways.—The city of Chicago can use the funds provided for by Traction Ordinance Feb. 11, 1907, Section 24, comprising a percentage of the net earnings of the traction companies or any other available corporate funds to purchase or construct subways in the streets or to do necessary preliminary work to enable the city to determine whether such construction is advisable. An act authorizing cities to own, operate, or lease street railways, applies to underground and elevated as well as surface, street railways.—Barsaloux et al. v. City of Chicago et al. (Ill.), 92 N. E. 525.

Violations — Smoke Ordinance — Nuisance.—Buffalo City Ordinances, c. 42, Section 1, makes it unlawful for any person to permit the discharge of large quantities of smoke, having a natural tendency to cause injury, detriment, or annoyance to any person or persons, or the public, or to endanger the comfort, repose, health, or safety of the public, or detriment to business or property. *Held,* that a violation of such ordinance did not depend on whether the acts constituted a nuisance at common law, and hence requests to charge that, in order to sustain a verdict for the city, the jury must find that a nuisance existed, and that defendant's use of its premises was unreasonable, were properly refused.—City of Buffalo vs. Geo. P. Ray Mfg. Co. (N. Y.), 124 N. Y. S. 913.

Public Improvements — Statutes.—The power conferred by P. L. 1907, p. 707, empowering municipalities to construct sewage disposal plants, is not affected by the supplement to the borough act, dealing with the construction or purchase of a drainage or sewer system including a disposal plant, and enacting that the two questions may be submitted to the voters at one election, and on the same ballot, without requiring the proposition to instal a disposal plant to be used in connection with an existing sewerage system to be first submitted to popular vote.—Wormser-Goodman Const. Co. et al. v. Borough of Belmar (N. J.), 77 A. 466.

Acts Authorized by Statute—Operation of Sewage Plant.—A county, through a commission created by Loc. Acts 1900-01, p. 1702, constructed as authorized by the act a sewer system and purification plant after contracting with an individual, who, in consideration of the exclusive right to use the products of the plant, bound himself to pay the cost of the plant and its maintenance. The county stipulated for the exclusive control of the purification of the sewage. The plant was built, and the individual operated it and paid the cost thereof directly. The plant was unequal to the accomplishment of its purpose, and a nuisance was created by its operation. *Held,* that since, in the absence of express statutory provisions, it

could not be assumed that it was intended to legalize an act necessarily resulting in a nuisance, nor that the system would have been constructed except for treatment of the sewage in the purification plant, the proximate cause of the nuisance was not the statutory authorization, but the operation of the plant by the individual, and he was liable therefor.—Adler & Co. et al. v. Pruitt (Ala.), 53 S. 315.

Highways — Ownership. — Streets and highways belong not partially, but entirely, to the public at large, and the supreme control over them is in the Legislature. Any unauthorized obstruction which unnecessarily impedes or incommodes the lawful use of a highway is a public nuisance at common law.—Chambers v. Roanoke Industrial and Agricultural Assn. et al. (Va.), 68 S. E. 980.

Waters and Water Courses—Diversion. —A water company will be temporarily enjoined from operating artesian wells, where it is definitely shown that a large spring, whose waters are used by its owner for commercial purposes, is thereby rendered entirely dry.—Ross Common Water Co. v. Blue Mountain Consol. Water Co. (Pa.), 77 A. 446.

Measurements and Estimates—Decision of Third Person.—Parties to a contract for a street improvement consisting of excavating and the laying of a pavement may provide that all measurements and estimates of quantities of work shall be made by a third person, and that his determination shall be final. The estimates of a third person authorized by the parties to a contract to make estimates which shall be conclusive cannot be impeached by either party without a showing of fraud or mistake so gross as to imply bad faith of the third person, or his failure to exercise his honest judgment on the matters submitted to him.—McKivor v. Savage (Wash.), 110 P. 811.

Improvements—Estimates of Quantity of Work Done.—The judgments of the city engineer selected by the parties to a contract for a street improvement consisting of excavating and the laying of a pavement to make measurements and estimates of the quantity of the work which shall be conclusive cannot be impeached by proof that on a measurement by another engineer it was found that rather more excavation had been done than the city engineer's estimates showed, and that in certain places the concrete base and sand cushion were thicker than four inches, a uniform thickness of four inches being one of the dimensions used by the city engineer in making his estimates; it being conceded that the city engineer exercised his best judgment.—McKivor v. Savage (Wash.), 110 P. 811.

Street Improvement—Contracts—Construction.—A contract for a street improvement consisting of excavating and the laying of a pavement, which provides that the yardage shall be ascertained by measuring the cubic yards in the concrete base and adding thereto the number of cubic yards of sand used in the sand cushion and in the filler, does not allow for all materials furnished and put into the concrete, and, where yardage measurement of concrete when mixed is less than the sum of yardage measurements of the materials of which it is composed, a method of measurement need not be adopted that will allow a yardage equal to the yardage of the sand and gravel furnished if measured separately.—McKivor v. Savage (Wash.), 110 P. 811.

Status of Land Over Which Street is Dedicated—Necessity for Acceptance.—The status of land over which its owner has dedicated a street is that, while the owner may be estopped from retracting his dedication, yet, until there is an acceptance of the street by some municipal act, or by public usage, the public acquires no rights therein and is subject to no duties by reason of the dedication.—Atlantic & S. Ry. Co. v. State Board of Assessors et al. (N. J.), 77 A. 609.

Municipal Corporations—Contracts.—A stipulation of a contract awarding to a person the right to collect and remove the garbage of a city for a specified sum that no assignment of the contract or any part thereof shall be made without the consent of the city first obtained is valid to discourage collusion among probable bidders, and to prevent extortionate contracts from being forced on the city, and equity will not enforce a prior contract between such person and others for the carrying on of the contract as a partnership. Where a person has entered into two independent contracts with different persons, each valid and enforceable, equity will not compel him to violate provisions of one of the contracts to the injury of the other party thereto for the purpose of affording relief under the other contract.—De Vita v. Loprete et al. (Me.), 77 A. 536.

City Council—Place of Meeting.—Under Ky. St., Sec. 3633 (Russell's St., Sec. 1639), requiring all meetings of the city councils of cities of the fifth class to be held in places designated by ordinance, an ordinance passed at other than the regular meeting place is invalid.—Dunn v. City of Cadiz (Ky.), 130 S. W. 1089.

Ordinances—Attack—Estoppel.—A property owner is not estopped to attack the validity of an ordinance requiring her to lay a sidewalk, in an action by the city to enforce a lien for the cost of a sidewalk built by the city, through failure to test validity of the ordinance by the statutory remedy of writ of prohibition, where she served notice that she would not pay for the work, and notified the city and its contractors not to do it.—Dunn v. City of Cadiz (Ky.), 130 S. W. 1089.

Dedication—Implication.—Where there was no express dedication of land for a public highway, but the public authorities assumed control of it, and worked and

used it as such, the public acquired merely an easement, leaving the fee in the abutting owners, so that such owners could lay water pipes below the surface to supply dwellings.—Wells et al. v. Village of Croton on Hudson (N. Y.), 124 N. Y. S. 1058.

Receivers—"Corporation for Public Improvement."—A corporation furnishing water to the inhabitants of a town, and to the town for municipal purposes, including service to fire plugs, and occupying the streets of the town with its conduits, though the corporation has not been given the right of eminent domain, or any other right usually accorded to quasi public corporations, is a "corporation for public improvement," within the statute providing that the act authorizing the appointment of a receiver of an insolvent corporation shall not apply to a corporation for public improvement.—Thoroughgood v. Georgetown Water Co. (Del.), 77 A. 720.

Contracts.—Where one entered into a contract with the proper county authorities for the furnishing of material and for the building of a courthouse, and the work contemplated by the contract was finished and accepted by the proper county authorities before the contract was entered on the minutes of the ordinary, such a contract was unenforceable until entered on the minutes of the ordinary; but where this was done after the completion of the work, in compliance with a judgment in mandamus proceedings instituted to compel the entry of the contract on the minutes, the defect resulting from a failure to enter the contract on the minutes before the work was begun or completed was cured, and the contract was enforceable by an action instituted therefor.—Wagener for Use of Bank of Cumming v. Forsyth County (Ga.), 68 S. E. 1115.

Injuries to Pedestrian—Contributory Negligence.—One employed as a street cleaner must, while at work, use ordinary care to avoid injury from passing vehicles, but he need not neglect his work to escape collision with those not using reasonable care.—O'Donnell v. Lange (Mich.), 127 N. W. 691.

Improvements—Contracts—Injunction.—A taxpayer may sue to enjoin a city and its officers from contracting for the construction of a sewer partly in the city and partly in a town, where a part of the cost of the improvement is charged to the city as benefits payable out of the general taxes, and where the contemplated improvement is unauthorized and void.—Loeffler v. City of Chicago et al. (Ill.), 92 N. E. 586.

Local Improvements—Ordinance—Resolution.—Under Local Improvement Act (Hurd's Rev. St. 1908, c. 24) Sec. 9, providing that the recommendation of the board of local improvements shall be prima facie evidence that the preliminary requirements have been complied with, and a variance shall not affect the validity of the proceedings, unless the court shall deem the same wilful or substantial, the resolution for a city improvement and the ordinance must agree as to the substantial features of the improvement; but the object of the statute is attained where the description of the improvement in the resolution, taken with the estimated cost, will give the property owners a general understanding of what is to be done.—City of Chicago v. Sonkup (Ill.), 92 N. E. 564.

Bonds—Sinking Funds.—Const., Sec. 159, requiring provision to be made for a sinking fund to redeem municipal bonds, does not require a levy sufficient to retire the principal of the bonds, without regard to accumulations to the sinking fund on account of its interest earnings; it being presumed that the fund will be invested in some safe way, which will produce annual interest, thereby lessening the taxpayers' burden.—E. T. Lewis Co. v. City of Winchester (Ky.), 130 S. W. 1099.

Officers—Individual Liability for Money Applied to Unauthorized Purpose.—Municipal authorities are not personally liable in an action to recover money lawfully collected by them for one purpose, but applied to some other lawful liability of the municipality, unless some charter provision or the general law of the state imposes a liability on them in such instances, or unless their action puts it beyond the power of the municipality lawfully to raise, during the current year, the money with which to discharge the obligations for which the funds thus misapplied were originally intended.—McCord et al. v. City of Jackson et al. (Ga.), 69 S. E. 23.

Contracts—Validity.—Where, at the time when the municipal authorities made a contract for the purchase of materials for the erection of water works and an electric light plant, which they were authorized to erect, they did not contract for a sum to be paid exceeding the available funds on hand for the payment thereof and the amount of taxes levied, or that might be lawfully levied, for the year for that purpose, the contract was not invalidated if subsequently, without the consent of the parties with which they contracted, the authorities applied such funds to other purposes, instead of paying off the amount thus contracted; and under such circumstances the parties so furnishing such materials under such contract would be entitled to a judgment against the municipality.—McCord et al. v. City of Jackson et al. (Ga.), 69 S. E. 23.

Franchises—Power of Revocation.—The franchise to operate a street railroad springs from the state, and not from the city where its lines lie, though it is essential that the consent of the municipal

authorities should be secured, and hence the right to revoke the franchise rests in the state, and the municipality can not move to compel a removal of such a company's tracks on the ground that they constitute a nuisance, not from operation in a manner not authorized by the grant, but for mere nonuser. The control which a municipality exercises over the public streets is in trust for the state, and not as a corporate or municipal property.—City of New York v. Montague et al. (N. Y.), 124 N. Y. S. 959.

Construction—Rights in Streets—Constitutional Provisions.—Const. Art. 11, Sec. 4, providing that no law shall be passed by the general assembly granting the right to construct and operate a street railroad within any city, town, or incorporated village without acquiring the consent of the local authorities having control of the streets or highways proposed to be occupied by such railroad, did not confer on cities and villages the exclusive control of their streets, and hence did not preclude the passage of Act May 27, 1889 (Laws 1889, p. 223), giving to the railroad and warehouse commission jurisdiction to determine the manner in which one railroad shall cross another in so far as it relates to crossings within the streets of cities and incorporated villages. While a municipal corporation is vested with the control of the streets within its corporate limits, such control is not exclusive, but is subject to the superior control of the state.—Chicago & S. Traction Co. v. Illinois Central Ry. Co. (Ill.), 92 N. E. 583.

Public Ways—Dedication—Acceptance.—A street laid out and plot recorded is a dedication to the public, but it is not a public highway for all purposes until accepted, which may either be by user or by appropriate municipal action.—Corbett v. City of Wilkes-Barre (Pa.), 3 Municipal Law Reporter 65.

Taxation—Electric Power Companies.—An electric power company is a quasi-public corporation, and that part of its real estate which is necessary for the exercise of its corporate franchises is not liable to local taxation.—Martic Township School District v. McCall Terry Power Co. (Pa.), Vol. 2, Municipal Law Reporter 91.

Vacation of Road.—A private terminus not a place of necessary public resort, cannot be left by vacation of a public road. It cannot be held that the private residence of a farmer, together with his other farm buildings, is a place of public resort contemplated by the statute.—Pine Grove Township Road (Pa.), Vol. 2 Municipal Law Reporter 120.

Exclusive Privilege of Collecting Garbage.

Judge Garbreath, of the civil court of Butler, Pa., has handed down an opinion granting the injunction against Johnson & Logan, restraining them from collecting garbage in Butler, the court sustaining the exclusive contract now held by A. W. Wallace. The court held that the garbage ordinance did not create a monopoly; was constitutional and valid, and was a proper exercise of the police powers of the borough; that A. W. Wallace, in his license for the garbage contract, had a property right which was being taken from him by the defendants and for which Wallace had no other remedy at law.

Louisville Sewer Bond Case.

The Legislature of Tennessee in 1909 passed an act allowing the city of Nashville to issue five hundred thousand coupon bonds, the proceeds of which were to be used for the construction of trunk sewers in the city. The city council passed an ordinance submitting the proposition to the voters of the city at the regular election held in the city October 14, 1909, at which time the city officials were elected, and at this election the candidate receiving the highest number of votes received 9,691. Only 5,982 were cast at the election on the bond proposition, 3,909 being for the issuance and 2,072 against them. The contention of the complainants was that the city was not authorized to issue the bonds unless the proposition for that issuance received a majority of all the votes cast at the election.

The court held: First, that the proposition carried by receiving a majority of the votes cast on the proposition; second, that the city, being authorized under section 19 of its charter, to submit the proposition either at a special or general election held in the city, that the fact that the city submitted the propositiion to the voters at the election held for the election of city officials did not divest it as to the bond proposition of the legal characteristics of a special election. Henry Sperry et al. vs. Mayor and City Council of Nashville, Tenn.

What Constitutes Equipment.

In the case of the Darlington Electric Light and Water Power Company, of Darlington, Wis., the Railroad Commission of Wisconsin has defined what shall constitute equipment under the terms of an appraisal to fix rates. The petition filed by the company alleged that its income from electric service and for pumping water was grossly inadequate, and sought authority to increase its schedule of charges. Careful examinations and apportionment of memoranda of receipts and expenditures were submitted by the petitioner, disclosing net earnings that were not considered by the commission to be unreasonably low.

The most interesting part of the decision was that referring to the equipment of the plant. Where equipment is not

actually part of the producing plant, but has been retained and serves as an emergency or reserve unit, it was held to be properly included as property useful in serving the public. Equipment which has been cast aside for larger or more up-to-date units was held to be not included as a part of the valuation serving as a basis for the adjustment of rates. In accordance with this and other conclusions of the commission, the petition was dismissed.

Right to Tax Gas Mains Sustained.

In the case of the City of Erie vs. The Pennsylvania Gas Company (Municipal Law Reporter, vol. ii, p. 81), a peculiar point was established. The defendant, a natural gas company, was authorized by ordinance to lay its pipes in Erie, and at once laid mains, which, with extensions, amounted to 100 miles in 1909, and supplied gas to about 14,000 customers. These mains were inspected and maintained by the gas company.

In April, 1908, a city ordinance was passed providing for an annual (or more frequent, if needed) inspection of all companies maintaining pipes or mains in the streets or alleys. The duty of this inspection was delegated to the police department of the city; and to cover the costs an annual license fee of $30 for each mile of main was provided. The gas company declined to pay this license fee, and suit was entered to recover the same.

The legal conclusions determined by the decision in favor of the city were, briefly, as follows:

First—A city has the right, in the exercise of its police powers, to supervise and inspect lines of mains which are located in its public streets, and to impose a reasonable charge as a license fee to reimburse it for the probable expense of such inspection and supervision, and the action of the city officials in such case is valid.

Second—The court may not interfere except where the license fee is clearly excessive and unreasonable.

Third—In deciding whether such license fee is clearly excessive and unreasonable, each case must stand largely on its own facts.

Fourth—While the license fee in question ($30 per mile of main) may seem large, it was not clearly evident that it should be set aside.

Fifth—A judgment was entered for the city of Erie for $3,000, with interest and costs.

ROADS AND PAVEMENTS

Road Supervision—Automobiles in Municipal Work—Electric Motor Fire Apparatus—Seattle's Civic Plans Commission

Road Supervision.

Supervision is the foundation stone on which road-building reform must be placed. Lack of management has been the cause of the enormous amount of waste in road expenditure. The outlay on township roads in Ontario, in statute labor and money, exceeds two millions annually. This is steadily increasing. Statute labor in pioneer days was the right thing in the right place. To-day it is more than undoing the good done in former years. Not only is statute labor of to-day inefficient in itself, but cash expenditure is largely made in conjunction with statute labor, by pathmasters, on the statute labor basis, so that it places two-fold handicap on road improvement. If this large outlay were handled in such a way as to give good roads, the misfortune would not be so great; but with statute labor squandered, and a considerable cash expenditure in its train, we still have the evil of bad roads. County roads systems with provincial aid are undeniably beneficial, but while increased outlay is needed, the greatest good can come from such an awakening on the part of the ratepayers as will lead to skillful direction of all expenditure now being made in the rural districts.

The remedy is not simply the abolition of statute labor. That is a minor part. The important feature is the system adopted in place of statute labor. Not only must that system be thoroughly efficient and practical, but it must be carried out with energy and good judgment. No system, however thorough, can be of use if left to itself; it will not be automatic. What is required is an active working out of an efficient system by men upon whom its administration falls, backed up by a clean-cut and healthy public opinion.

Road building, as with any other constructive work, has two parts, the theoretical and the practical. The one pertains to the engineer; the other to the contractor or foreman. The one includes the knowledge of what the completed road should be as regards materials, form, drainage, and the application of scientific principles to the design of a road. The other involves the direction of labor so as

to produce maximum results at minimum cost.

How do pathmasters, trying to build roads with statute labor, serve these conditions? Without overestimating the scientific ability necessary to build roads, it is safe to say that in no township can one or two hundred men be found who, as pathmasters, can qualify as road engineers; while to expect them as foremen to efficiently manage statute labor as well is a travesty on the art of road-making.

No two pathmasters can agree as to what a road should be as to width, crown, grade, drainage, quality of material; yet it is only by the skillful treatment of such details that a good road can be cheaply and durably designed. A defect in one particular may readily mean the undoing of the entire work. In teaming material, which is one of the great factors of cost, the size and number of loads per day often does not amount to one-third or one-quarter what a contractor or good foreman would exact. This means in effect that, for a given quantity of material, the cost of teaming is three or four times what it should have been. In many townships a rate of $3 or $4 per day for man and team is nominally paid, yet it really amounts to $12 or $16 for a full day's work. This is the rigid economy being practiced on the township roads of Ontario, as their condition fully testifies.

The organization which should exist is very simple—that of a joint stock company. The ratepayers are the stockholders; the council, the board of directors; and there should be one permanent manager (or road superintendent) carrying out the wishes of the directors. This centralizes responsibility, while the growing experience of the superintendent will be of increasing value. So long as municipal councilors rotate in office from year to year, their services in actual supervision of road work can be only a series of experiments, in which they gain their experience at the expense of the people. If there is need for a permanent clerk or treasurer, much more is there need for a permanent road superintendent.

Cities and large towns, as a rule, have such a system in the employment of a city engineer who can supervise, through foremen and inspectors, all work of either day labor or contract. County councils, in carrying on systems of county roads under the highway improvement act, are required to have a road superintendent or engineer, while their steel truss bridges must be constructed under a qualified engineer who can see that the plans and specifications are properly carried out.

The duties of a road superintendent will vary in detail according to local circumstances, and the municipality in which he is engaged, whether township or county. In general, he should attend all regular meetings of the council to receive instructions from the council, or give information regarding work proposed or in progress. He should report to the council in the spring as to work he considers advisable, which report the council may adopt or amend. He should report at the end of the year, showing a full statement of work carried out and the cost. It will be his duty to purchase all ordinary supplies, and make such recommendations to the council as may be desirable regarding machinery or other equipment needed.

All men, teams, foremen and inspectors should be employed or discharged by him, and should be subject to his direction only. A councilor should never give instructions as to work, except through the road superintendent. A contractor never gives directions to laborers except through a foreman or superintendent, and the same principle should be rigidly followed in municipay road work. To do otherwise destroys the superintendent's prestige with the men, undermines his power to preserve discipline and to secure the best work. Every man should feel that he owes his employment to the superintendent only, and that no "pull" can save him if the superintendent wishes to dismiss him.

The superintendent should keep an accurate record of men employed and the work done, furnishing to the council at regular intervals accounts and pay sheets. The methods of payment and the keeping of accounts should be complete and above suspicion, requiring the certificates of foremen, the superintendent and chairman of the road committee, and should have the approval of the council. Wherever possible the certificates of two men should be on every account and pay sheet presented to the treasurer.

Sufficient of the duties of the road superintendent have been suggested to show the object of having a road superintendent—to make it one man's business in every municipality to have direct charge of road work. If he is thoroughly practical and a man of business, he can prepare plans and organize the work so as to get the greatest results for every dollar expended. The council and people will hold him responsible for so doing. He will study the best methods of road construction, of operating machinery and of organizing the work. He should have what few men possess—the ability to manage men so as to get full results from them. In the last analysis, upon the ability and energy of the man in charge will depend the success or failure of the municipal road expenditure. Road improvement is a work not of one year, but of many years; it should be planned as such, and the first necessity is a man who will give it continuous attention for a term of years.

On work which he does not personally oversee the superintendent should place a foreman. The foreman will receive his instructions as to how the work is to be done from the superintendent, and the

foreman's essential qualification will be his ability to organize and control the labor to the best possible advantage. A first-class foreman is the most valuable part of any contractor's equipment. For a thoroughly efficient foreman a contractor will pay the highest market price, for he knows that the cost of the work may easily be one-half under one foreman of what it is under another. As with the superintendent or engineer, these foremen should be retained as permanently as possible, so that their growing experience will make their services of increasing value to the county.

So long as work is carried on in short patches, the need for expert supervision is not felt throughout the country. To build roads profitably they must be constructed in long sections, involving a very different degree of experience. A reeve recently pointed out to the writer with pride, "the first continuous mile of road to be built in the township." This is not an isolated case. Many townships in the province have yet to build their first continuous mile of road.

That the supervision of road work on each system—township, county, city or province—should be centralized is a principle that has been found valid wherever the best roads are being built. In France, Germany, England, and the American States advanced in road building, the centralizing of responsibility is recognized as a vital necessity. In this way expert knowledge is directed to the design of roads, and the forces available are directed by business-like methods adapted to any other form of construction. The country roads, looked at as a purely local quantity, do not impress with their importance; but as a part of the great transportation system spreading as a vast network throughout the province, the aggregate forms a work of magnitude, and the results of neglect will seriously retard the material development of the country.

W. A. McLEAN, Engineer of Highways,
In Report to Ontario Provincial Government.

Automobiles in Municipal Work.

At the Chicago automobile show, to be held in the Coliseum on February 6-11, city officials will be given an opportunity to appreciate the increased use of the automobile in various lines of municipal service. About 150 city officials have signified their intention of attending the show to investigate the motor police patrols, motor fire apparatus, ambulances and various styles of trucks suitable for street cleaning, garbage, and other municipal work. From many cities in Illinois, Indiana, Michigan, Ohio, Kentucky, Tennessee, Iowa and Wisconsin, all of the principal officials from mayor to city clerk, expect to attend the show.

The principal use found for the automobile seems to be in fire service. As the result of a carefully made count it is asserted that 200 American cities are now using motor fire apparatus. The record shows thirty-eight cities in Massachusetts, eighteen in California, fifteen in New York, fourteen each in Connecticut and New Jersey, twelve in Pennsylvania and eight each in Ohio and Texas. The central states are as yet but poorly represented in the list of cities which have adopted the more efficient fire-fighting machines.

Electric Motor Fire Apparatus.

Each month marks a further advance in the adoption of motor driven fire apparatus, and the sentiment is becoming more general in favor of its use in all cities. A recent meeting of New England fire chiefs adopted resolutions in favor of the motor apparatus. The fire commission of Buffalo has announced its intention of purchasing motor vehicles exclusively in the future. These are only some of the many instances of the growing favor of the more efficient apparatus.

The latest type of motor apparatus is the electrically driven truck. Springfield, Mass., was the first city in this country to adopt the electrically driven apparatus. It is a hose wagon 21 feet long, propelled by a motor on each wheel. Power is furnished by batteries; and a speed of 30 miles an hour may be obtained. The equipment of the wagon includes a 40-gallon chemical tank and reel with 150 feet of hose, 1,500 feet of large water hose, lockers for firemen's clothing, a turret pipe and the usual details of a hose wagon. The chassis was built by a Grand Rapids wheel company, and the body was built by a Springfield wagon works. An 85-foot electrically driven truck has been added to the fire department equipment since the adoption of the hose wagon.

That the electrical apparatus has received some notice in England is evident from the following description in a recent issue of the London "Surveyor and the Civil Engineer":

The machine is fitted with a special light-traction accumulator, and 25-mile journeys can be accomplished without any fear of injury to the cells. The current is supplied by two independent motors, fixed on either side of the frame, the drive being by means of a worm-wheel reducing gear and chains on to the rear wheels. Friction is reduced to a minimum by the employment of roller chains and oil-tight cases for the worm gearing. This engine will carry six or eight men at a speed of 20 miles per hour on the level and a gradient of 1 in 10 can be ascended at a good speed. Artillery pattern wheels are fitted, the tires being solid rubber and of twin section on the rear wheels. The engine carries a "Kemik" cylinder of a capacity

of 30 gallons, which is kept under pressure by a cylinder of carbonic acid gas, and discharges through 180 feet of 1-inch rubber hose. (The cylinder can be operated by an acid and soda charge, instead of the gas cylinder, if preferred.) Accommodation is also provided for 1,000 feet of canvas hose, with standpipes, branchpipes and all the necessary material for getting to work from a hydrant. A set of telescopic ladders to reach a height of 30 feet is also carried in brackets overhead.

Seattle's Civic Plans Commission.

A civic plans commission is provided for in a recent amendment to Seattle's city charter. This commission is to be composed of representatives of the city and county authorities, the chamber of commerce, the banks, real estate, water front, harbor and manufacturing interests, the legal and arichtectural professions and the steam and electric railways. Twenty-one members in all compose the commission. R. H. Thomson, M. Am. Soc. C. E., city engineer, has been made a member of the commission. The purposes of the commission will be aided by the appointment of various sub-committees to investigate the different lines of work and report to the main commission.

The commission has assumed for the purposes of its endeavor, a population of 1,000,000 embraced in an area of about 150 square miles. With this assumption plans are to be made to provide arterial highways, quick, accessible transportation facilities, parks, boulevards, playgrounds and civic centers.

The greatest amount of attention will in all probability be devoted to the harbor development, for with the opening of the Panama Canal, Seattle anticipates an increased shipping business which will require a great amount of additional dockage facilities. This work, which could not be accomplished by individual effort, the commission hopes to accomplish in such a manner as to develop the entire harbor as a unit. In this manner each improvement undertaken will have a result in the completion of the work.

In addition to these purposes, the commission will consider the labor problems, which are at present attracting so much interest in the Western Coast states. An effort will be exerted to prevent the closely built-up congested factory and tenement districts; and suburbs will be opened to give inducements to the poorer classes to build and rent homes away from the congested areas. To aid in this plan transportation facilities will be provided, and schools, parks and public playgrounds will be placed in the outlying districts.

Few immediate public improvements are planned by the commission, but it is its aim to lay before the people a comprehensive plan for a future great city; to submit maps showing the location of future docks, waterways and railroad yards, arteries of travel, boulevards, parks and playgrounds, so that as the territory contiguous to the present city is opened up and becomes a part thereof, it can be platted to conform to every other part of the city, thereby forming a unit which if rightly planned and successfully carried out will make Seattle not only a great commercial city, but a beautiful and healthful place in which to live.

Under the charter amendment, provision was made for employing an expert to assist in its work. Virgil G. Bogue, of New York, who constructed the Northern Pacific Railroad from Tacoma to Seattle and laid out the Seattle harbor, has been retained in this capacity. He will prepare and submit plans for civic improvement, which will be passed upon by the commission.

Municipally Furnished Houses in England.

The town of Newcastle-on-Tyne, England has furnished a very satisfactory solution for the slum problem. Two blocks of tenement dwellings have been erected upon corporation land, with their back to a twenty-foot street, and their face to the children's playground. Ten feet of this space form a pleasant avenue; thirty feet are utilized as front gardens to the houses. Here are seventy-two one-room dwellings in two stories. The blocks are divided from each other by a ten-foot passage, and access to the upper rooms is by way of a covered-in stone staircase at one end of each block, leading on to a balcony four feet wide. Each room is 15x11 feet and has a bay window 8-feet wide and projecting 2 feet 6 inches. A bed fitted with a wire mattress, occupies a recess 6x4 feet, and is screened by a curtain hung from a rod. There is a scullery portion 7x3½ feet, fitted with a sink, and a plate and pan closet. In the entrance lobby is a food locker and a coal bunker. The bay window is surrounded with fixed seats, which have lockers underneath. These single rooms are supplied with a wardrobe, containing a drawer and hat shelf; a combined dressing table and book rack; a plate rack with drawers and cupboards below; and even a rail for pictures.

These houses are rented for the sum of 12½ cents per day or 90 cents per week.

MUNICIPAL AND TECHNICAL LITERATURE

The Improvement of Fort Wayne, Ind.—Engineering Data—Cement Age—Books for Engineers

The Improvement of Fort Wayne, Ind.

A report has been compiled by Mr. Charles Mulford Robinson, of Rochester, N. Y., setting forth plans for the civic betterment of Fort Wayne, Ind. This report was prepared after a careful study of the local topographical conditions, and it is in its thoroughness indicative of an appreciation of needs of the city.

The compilation of the report is exceptionally good. The details of the city's ills are taken up separately and cures suggested, detailed suggestions being given in each case. Each point under discussion is illustrated by photographs, with topic sentences making clear the reasons for their use. In addition to these details, a general plan of procedure is outlined and the method of attaining the desired results is given.

In connection with the planning of a river drive several serious questions in engineering were involved. Mr. Charles C. Brown, of Indianapolis, was called into consultation to determine the safety of the proposed drive under flood conditions.

A section in conclusion deals with the financial questions involved and offers a comparison of the conditions in Fort Wayne with those in other cities of approximately the same size.

Engineering Data.

A unique little publication by Edward Wray, 92 La Salle street, Chicago, Ill., is entitled *Data*. It appears monthly, and the publication began in September, 1910. Each sheet is of the standard 3x5 size of stiff paper and those of a monthly number are lightly glued at one end so that they can be separated. Each card is devoted to one subject, which is printed in black-faced capital letters on the top line. The cards can be pulled apart and filed in alphabetical order in a standard card file, thus making them most convenient of access.

A serial list of headings used and of words that might be used as headings, but are not, is being printed on the earlier pages, thus giving a complete series of cross references. Any headings not found in the file of cards will probably be found in this list of "index headings" with reference to the heading under which the information can be found. The sheet or sheets of headings should be placed at the beginning of each corresponding letter of the alphabet for convenience of reference.

The folowing may be mentioned as examples of the information thus far printed under headings:

Four sheets regarding reinforced concrete beams appeared in October and November, two showing safe bending moments and reinforcement for beams of 5 to 48 inches depth and two showing proportion and spacing of rods for various sizes of rods.

Three cards on boilers, published in September, treat of boiler scale, efficiency of boilers with oil fuel and steam economies of boilers.

Two November cards give safe bearing values for brick masonry.

A September card gives a graphical showing of the cost of power house buildings of various types.

Cement Age and Concrete Engineering Consolidated.

Cement Age, of New York, and *Concrete Engineering*, of Cleveland, have been consolidated.

Mr. Robert W. Lesley will continue as editor of the new publication, which will be known as *Cement Age with which is combined Concrete Engineering*. Allen Brett, editor of Concrete Engineering, will take the position of associate editor.

Books for Engineers.

Reinforced Concrete Pocket Book, containing useful tables, rules and illustrations for the convenient design, rational construction and ready computation of cost of reinforced concrete girders, slabs, footings, columns, buildings, retaining walls, tanks, grain elevators, coal bins, water pipes, sewers, dams, bridges, smoke stacks, piles, etc. By L. J. Mensch, M. Am. Soc. C. E. Leather pocket book, 218 pp., $10. Published by the author, Monadnock Bldg., San Francisco, Cal.

The author has prepared a very practical book that will be found exceedingly convenient by the designing and estimating engineer. There is little lacking which is of interest in the field the little book is intended to cover. Data regarding the steel used and regarding structures of various dimensions of all the kinds named on the title page are arranged in tabular form for easy reference. Besides the subjects definitely mentioned there is given full information about the kind and amount of material required for forms

for girders, columns, beams, floors and their supports. Poles for lines of wire are treated. The treatment of the arch bridge is brief, but quite comprehensive. Cost of labor on reinforced concrete and form work is discussed, also cost of the less prominent materials, such as nails, water, cleaning up, etc. A set of general specifications for reinforced concrete work is given also.

Tables have been carefully checked repeatedly by slide rule and many of them have been in use for ten years and have been thoroughly tested during that time. Most of the information is such as cannot be obtained in other books, or at least in any but the very few books of the same class.

The author is an engineer and a general contractor actively engaged in difficult gineering and building construction and prepared the book for his own convenience primarily, and publishes it for the benefit of other contractors and engineers.

Economic Geology, with special reference to the United States, by Heinrich Ries, A. M., Ph. D., professor of economic geology at Cornell University. Cloth, 589 pp., $3.50 net. The Macmillan Company, 66 Fifth avenue, New York.

This is the third edition of a standard text-book, which has been revised and somewhat enlarged to keep it fully up to date. The student or reader is evidently expected to have a general knowledge of geology and minerology and one with such preliminary information can read the book without difficulty. However, the reader who knows little of these subjects finds the book full of interesting and valuable information for him, although he may not understand the scientific discussions which are used to correlate and explain the information given. The book is profusely illustrated with plates of photographs and drawings as well as some hundreds of illustrations on the pages of text.

Coal has a chapter of 49 pages; petroleum, natural gas and other hydrocarbons have 51 pages; shorter chapters are devoted to building stones, clay, lime and calcareous cements, salines and associated substances, gypsum, fertilizers, abrasives, minor minerals, precious stones and underground waters.

The second part on ore deposits begins on page 305, with a general chapter on ore deposits, their occurrence, method of formation, age, etc., followed by chapters on iron, copper, lead and zinc, silver-lead, gold and silver ores, and two chapters on the minor metals.

The statistics of the U. S. Geological Survey are used in connection with each mineral and much additional information about quantities, qualities, prices, values, etc., is given from the additional wealth of data the author possesses.

There is much new material in the book, more than is shown by the additional 145 pages in this edition, for the type has been entirely reset and the style changed so that each page contains considerable additional matter.

The Collection and Disposal of Municipal Waste. By Wm. F. Morse, consulting engineer. Cloth, 462 pp. Municipal Journal and Engineer, New York.

The author of this book has been identified with the American development of the subject of which it treats almost ever since the beginning of its consideration in this country and he is competent both in ability and experience to give a full statement of what has been done, and of what has been attempted and the reasons for the failures, and his recommendations for the future are worthy of most respectful attention.

The five parts into which the work has been divided consider the municipal waste of American towns, the disposal of American municipal waste by crematories and incinerators, the disposal of waste by British destructor systems, the disposal of waste by reduction and extraction processes, and the utilization of municipal waste. This method of classification causes considerable repetition in order to make each part complete without cross-references to other parts, but this is not a serious objection.

The chapters of the first part consider the present conditions of waste collection and disposal in American cities and towns, showing the lack of system in the individual method of disposal, feeding, licensing cartmen, letting contracts for collection and removal, and collecting by municipal employes, as methods of collection; and dumping or tipping into water or on land and refuse sorting as means of disposal. The second chapter gives a close classification and clear definitions of the various classes of refuse, both organic and inorganic, and contains about all the available information regarding proportions and quantities of each class of municipal waste. The third chapter describes the methods of refuse disposal, meaning combustible matters and inorganic incombustibles, in Boston, New York, Brooklyn, Buffalo and Lowell. The fourth chapter shows the treatment of municipal ashes, street sweepings and stable refuse, and discusses briefly the commercial values of municipal waste, including the tankage from garbage reduction plants.

In the second part the fifth chapter gives brief descriptions in approximately chronological order of the early American garbage disposal plants, mainly crematories and incinerators. The sixth chapter is a table of the main facts regarding all the municipal garbage furnaces, arranged in chronological order, with a number of notes on patents and cost of construction, and additional tables of garbage crematories erected by the U. S. government and at public and private

institutions. There are many miscellaneous notes showing reasons for failure and for slow progress, etc. The seventh and eighth chapters describe in detail the various American crematories, thus repeating to some extent previous chapters, and include the Engle, Dixon, Davis, Thackeray, Boulger, Morse-Boulger, F. P. Smith, Wright, Branch, Brown, Brownlee, H. B. Smith, Smith-Siemens, Vivarttas, Decarie, Bennett, Dundon, Sanitary Engineering Co., Lewis and Kitchen, and Public Service Co., furnaces. The ninth chapter describes the traveling crematories and rubbish destructors and gives a careful compilation of all the available information on the calorific value of municipal wastes of the various classes. It also discusses again the differences in forms of furnaces and the conditions necessary to their success.

In the third part, the tenth chapter goes into the details of British destructors, describing the Fryer, Beaman and Deas, Horsfall, Warner and Sterling destructors of the cell type and the Meldrum, and Heenan & Froude destructors of the continuous grate type, the high temperatures attained and the conditions of operation. The destructors of these types in America are described in detail. They are located at Westmount, Montreal, Que.; Seattle, Wash.; Vancouver, B. C.; West New Brighton, New York, and one under construction at Schenectady, N. Y. The eleventh chapter, written by W. Francis Goodrich, the eminent English authority on waste disposal, describes British destructor plants which have been installed in all parts of the world. The uses made of the products of the furnaces are also named.

The fourth part, on reduction and extraction processes, describes all the plants in the United States, using the Merz, Simonin, Arnold, Chamberlain, Holthaus, Wiselogel, American, Penn, and Edson processes.

The eighteenth chapter, which constitutes the fifth part, is devoted to a discussion of the economic side of the question and discusses the uses which can be made of the products of waste disposal and the revenue that can be derived therefrom.

Aside from the repetitions which might have been diminished in amount by more careful editing and a number of typographical errors, which show careless proof-reading, the book is as satisfactory in form as it is in contents, and will long be valuable as the first successful attempt to cover its subject for America as well as foreign countries. A material improvement in methods of collecting and disposing of garbage is probable in the near future; but this book will, nevertheless, long serve the purpose of the engineer who wants to know what has been done in these lines and the principles upon which the successes of the past have been based, as well as the reasons for many of the failures.

ORGANIZATIONS AND INDIVIDUALS

American Society of Civil Engineers—Standardizing Specifications—Chicago Cement Show—Engineering Contractors—Indiana Engineering Society—Highway Improvement—Illinois Society of Engineers—Civil Service—Technical Schools—Technical Organizations—Calendar—Personal Notes

American Society of Civil Engineers.

The annual meeting of the American Society of Civil Engineers was held at the society house in New York January 18 and 19. Special committees on steel columns and struts and on bituminous materials for road construction were made and the result of the election of officers was announced, Admiral Mordecai T. Endicott being elected president.

There was some very interesting discussion of the licensing of engineers by the state apropos of the introduction of bills in the last two legislative sessions in New York and the passage of laws in other states whose tendency is toward reducing the profession of civil engineering to the level of a trades union. A resolution was passed to the effect that the society "does not deem it necessary or desirable that civil engineers should be licensed in any state," in view of the fact that national societies of engineers have large and widely scattered membership among those who have demonstrated their fitness to practice as engineers before they could secure these memberships. At the same time the society passed a resolution recommending a form of statute in case a legislature deems the passage of a statute covering the practice of civil engineering desirable for the protection of the public. This form was not satisfactory to many of those present, and the recommendation of any form was objectionable to many,

but, under the rulings regarding the reference of the question to the board of direction, the resolutions were accepted mainly as a progress report of the board, which was continued in charge of the matter. MUNICIPAL ENGINEERING will comment upon the subject editorially a little later, believing that the basis of the proposed form of statute is not the most satisfactory and that the state, aside from its police powers, which need not be invoked in such a matter as this, has the right only to prescribe qualifications of engineers to be employed by the state, county or municipality.

The annual report of the board of direction shows a total membership of 5,797, the increase during the year being 505. The society paid $10,000 on the indebtedness for building and put $17,000 into the reserve fund, drawing higher interest than the mortgage, and payments of $10,000 on indebtedness and $20,000 to reserve fund have been ordered to be made early in 1911.

Following the excursions of the membership on the 18th and 19th, a series of special meetings to discuss road construction was held under the direction of the society's committee on bituminous materials for road construction on January 20 and 21. The general result of these discussions is stated in the editorial department. Many interesting and valuable items of information gathered therefrom will be given in MUNICIPAL ENGINEERING from time to time.

Standardizing Paving Specifications.

The Organization of City Officials for the Standardization of Paving Specifications held its second convention in the United Engineering building, New York city, January 9 to 14, inclusive, taking up the tentative specifications adopted last year and working them into more satisfactory shape. The convention did not get into working order as promptly as it did in Chicago, nor did it put in as many hours a day, although it managed to use all the days in the week. The general result is commented upon in the editorial department.

There were 73 delegates from 32 cities in attendance for at least a part of the time, though scarcely two-thirds of the cities responded to any one roll call. This indicates a falling off of interest, especially as several cities present at Chicago were not represented in New York. Indeed, there were frequent expressions on the floor and in the lobbies to the effect that the organization will have completed its work by the end of its third convention and may then turn its work over to the more inclusive American Society of Municipal Improvements for future elaboration and modification to keep it up to the future advances in the science of paving. A committee on reorganization was appointed to report at this convention, but the report was not forthcoming. If the sentiment expressed as above reported is sufficiently wide-spread it may never report. Some anomalies arising from changes in the incumbents of municipal offices must be corrected or the conditions of membership must be modified if the organization is to remove some of the just causes for criticism which appeared at this convention.

To prevent unauthorized use of the specifications for advertising purposes, the preliminary reports were copyrighted and the final specifications will not be issued in any form until they have been printed and copyrighted by the organization, when they will be open for any legitimate use.

American Society of Engineering Contractors.

The annual meeting of the American Society of Engineering Contractors was held in the United Engineering Society building, New York City, on the afternoon and evening of January 10, 1911.

The principal business transacted was the counting of the vote for officers and the discussion of reports of committees on uniform specifications, and cost analysis. In the evening Hilder Daw of Montreal gave a most interesting illustrated lecture on "Railroading in West Africa," which was followed by a collation.

W. R. Harris of Louisville, Ky., was elected president of the society.

The Chicago Cement Show.

The Cement Products Exhibition Co., announces that the opening date of the Fourth Annual Chicago Cement Show has been advanced one day. The show will open at 8 p. m., February 16; and continue until February 23.

The entire Chicago Colisemu main floor, balcony and annex will be filled with exhibits. The year's progress in cement, cement products and cement machinery will be displayed according to an orderly and attractive plan.

To the architect, the engineer, the contractor, the business man and the home builder this show should prove not only of great interest, but should be of real value; for in no other place or manner are the many uses of cement, so thoroughly taught.

The Indiana Engineering Society.

The annual meeting of the Indiana Engineering Society was held at the Denison Hotel, Indianapolis, Ind., on the 12th, 13th and 14th of January. There were four business sessions and in addition a banquet was held on Thursday night, and an inspection of the Merchants Heat and Light Company and the Citizens Gas Company, was made on Friday afternon.

In his opening address on Thursday morning, President Edwyn E. Watts, of Princeton, called attention to the very low compensation allowed for public engineers in the State of Indiana. In this connection he mentioned the enormous amount of public work that was under the supervision of these engineers. Men capable of handling such work can find more remunerative positions in other lines.

Prof. W. K. Hatt of Purdue University, read a report as chairman of the committee on materials and construction. In this report he dwelt on the need of standardizing specifications; the revision of the rattler tests for brick; and the advancement being made in the matter of suitable wood preservatives. In the discussion following this report, C. W. Boynton, of the Universal Portland Cement Co. commented on the fact that concrete may be made as water tight as stone if a properly proportioned mixture is made, and sufficient water is used. Prof. Hatt made mention of a new substance called makalite, composed of carbolic acid and formaldahyde, which is being tested for its value as a wood preservative.

Prof. Hatt read a paper on wood paving blocks in which he brought out several valuable points. He emphasized the fact that contrary to the popular idea, coarse grained blocks will not absorb the creosote or oil as well as the finer grained woods. Prof. Hatt's paper was illustrated by a number of microscopic sections of woods which showed the cellular structure, and brought out the points discussed. Following this Mr. Boynton gave a very interesting talk on the manufacture of Portland cement, illustrated by a number of slides.

In the Friday morning session, Prof. R. L. Sackett read a report on the river and stream pollution in Indiana. This was followed by the report of Charles Brossman as chairman of the committee on water works, in which the need for uniform hydrant and hose connections was strongly emphasized. Theodore A. Leisen then presented a paper on the evolution of the Louisville water works. A full description of the newly improved pumping station was given. This was followed by an illustrated description of European sewage purification works, by Prof. Sackett. The Imhoff and Travis tanks were fully described and their action indicated. The traveling sprinkling filters were compared with the types used in this country. Mr. Brossman then read an illustrated historical paper on wells and well pumping machinery.

In the report of the committee on roads and pavements, given by Mr. John O. Potter, attention was called to the fact that judgment is not always shown by petitioning property owners in choosing the kind of pavement suitable for their needs. In the discussion of the report the relative merits of screened and crusher stone were argued, with the odds in favor of the crusher run. Indiana's "systematically unsystematic" road building was severely criticised.

Prof. Albert Smith read a paper on "The Relation of Bridge Specifications to Highway Improvements," which will appear later. Elsewhere in this issue will be found the paper which followed on the "Standardization of a Testing Rattler," by M. W. Blair.

Frank R. Daniel, in offering the report of the committee on central station light and power, recommended wire taps from pipes to return conductors to avoid electrolytic action. The increased use of welded rail joints was commented upon with favor. Prof. Hatt's paper on the new testing laboratory at Purdue, was read by Prof. Smith.

The description of a forty-foot concrete girder bridge, by F. A. Kattman started a very interesting discussion concerning the relative merits of the arch and girder types of bridges for highway use.

A number of other very interesting papers and reports were read, of which lack of space prevents mention. A number of papers and reports were read by title only and will appear in the publication of the society. D. B. Luten was elected president, and Malverd A. Howe vice president. Prof. H. O. Garman and DeWitt V. Moore were elected trustees.

One of the distinctly novel features of the convention was the use of the convertible baloptican. y the aid of this machine the ordinary drawings and photographs were made use of as well as lantern slides. The baloptican feature involves the principal of the mirror projecting the image at an angle through a lens to a mirror which in turn throws the image upon the screen. This produces an image which is erect and identical with the original.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

February 8-9: Topographic draftsman at $1,000 to $1,500 a year, copyist topographic draftsman at $900 to $1,500 a year, aid at $720 a year and deck officer at $900, all in the Coast and Geodetic Survey.

The American Association for Highway Improvement.

This new association is beginning its life in a way which indicates that it will be of great value and influence in the field. A hand-book giving the purposes of the association and its working plan, and constitution will be sent on application to the secretary, J. E. Pennypacker, Jr., Colorado building, Washington, D. C. It also contains a plan for the organization of local road clubs.

The association has under preparation

a legislative hand-book, giving carefully prepared models of acts covering various parts of the field.

Its plan of work is comprehensive and its membership should be large that there may be funds for carrying it on.

The Illinois Society of Engineers and Surveyors.

The Illinois Society of Engineers and Surveyors celebrated its jubilee at its 26th convention, held in East St. Louis, January 25-27. An excellent program was arranged under the presidency of A. N. Johnson, the state highway engineer The evening session of the second day was devoted to the jubilee and included talks from charter members of whom there are still eight holding membership in the society, and past presidents, of whom there are at least ten still members of the society.

Technical Schools.

"Freight Train Resistance: Its Relation to Car Weight," by Edward C. Schmidt, has just been issued as Bulletin No. 43 of the Engineering Experiment Station of the University of Illinois. This bulletin presents the results of tests made upon freight trains to determine their resistance. The results show that the average weight of the cars composing the trains exerts upon train resistance an even greater influence than is exerted by variations in train speed.

The Carnegie library of Pittsburg has issued two valuable lists of references and magazine articles. The first of these is a select list of books on Industrial Accidents; while the second is a complete list of books and articles on Sewage Disposal and Treatment.

The Iowa Engineer, published by the Iowa State College at Ames, Iowa, contains among other articles, a paper on the Manufacture of Portland Cement, by Geo. P. Dieckman of the Northwestern States Portland Cement Co.

The January number of the Wisconsin Engineer contains a number of articles of interest. Among them are Telephone Service in Chicago, by A. U. Hoefer, and The Utility of the Metallographic Microscope in Engineering, by James Astor.

Technical Organizations.

The eighth annual banquet of the Municipal Engineers of the City New York was held at the Hotel Savoy on January 7. After refreshments had been enjoyed, a number of toasts were responded to. Hon. J. P. Mitchell, president of the Board of Aldermen, made a number of remarks concerning New York's engineering staff and then discussed the subway extension problem, which the city is now facing. Other speakers representing the city government were Borough Presidents McAneny and Miller. Mr. Charles Warren Hunt, secretary of the American Society of Civil Engineers, described the essentials of success in engineering as knowledge, industry and tact; these three; but the greatest of these is tact. He qualified knowledge as technical knowledge, but in a broader sense than it could be acquired in technical schools. Following Mr. Hunt were speeches by Hon. Bourke Cochran, Mr. John J. Murphy and Mr. Louis K. Rourke. At a regular meeting of the society held on January 25, Mr. Henry W. Vogel was elected president and Mr. Clarence D. Pollock, secretary.

The following officers have been elected by the Brooklyn Engineers Club: President, Winfred H. Roberts; vice-president, John M. Steinmetz; secretary, Joseph Strachan; treasurer, William T. Donnelly.

The first annual convention of the Oklahoma Municipal League was held in the city council chamber, Oklahoma City, January 4-6. The following were among the addresses made: "Essentials of a State League of Municipalities,' Frank G. Pierce, Marshalltown, Iowa, secretary of the Iowa League of Municipalities; "Benefits That Should Result From a State Municipal League," Grant Foreman, Muskogee; "Importance of Municipal Accounting Among the Cities of the State," Prof. James H. Sawtell, chair of municipal science, State University, at Norman; "The State, the City and the Riparian Owner—The Sanitary Inter-Relation," Alexander Potter of New York, consulting engineeer for Muskogee and Oklahoma City; "State Laws Governing Public Works in Municipalities of Oklahoma," Charles L. Daugherty, State Labor Commissioner; "Municipal Illumination," A. Larney, Cleveland, Ohio; "Municipal Franchises," Robert L. Williams, associate justice of the supreme court; "Legal Status of the Commission Form of Government Under the Constitution and Statutes of Oklahoma," W. A. Ledbetter, Oklahoma City; "Control of Public Utilities," James E. Ellison, chief engineer Public Service Commission, St. Louis; "Modern Fire Protection," J. Ed Shautz, Dallas, Tex.; "How to Reduce Insurance Rates," C. T. Ingalls, Oklahoma City.

The Engineers' Club of Toronto has elected the following officers: President, C. M. Canniff; first vice president, Willis Chipman; second vice president, A. J. Van Nostrand; treasurer, L. J. Street; secretary, R. B. Wolsey.

The Louisiana Engineering Society has elected the following officers for the year: James C. Haugh, president; A. M. Lockett, vice president; L. C. Datz, secretary; James M. Roberts, treasurer, and Douglas C. Anderson, A. M. Shaw and A. M. Lockett, members of the board.

The American Society of Agricultural Engineers held an annual convention at Purdue University, Lafayette, Ind., on December 28. The questions of farm irrigation, drainage and sanitation occupied

the major portion of the program. The following officers were elected: C. A. Ocock, Madison, Wis., president; W. F. McGregor, Racine, Wis., first vice president; J. B. Bartholomew, Peoria, Ill., second vice president; J. B. Davidson, Ames, Ia., secretary; E. A. White, Urbana, Ill., treasurer; councilman, Howard W. Riley, Ithaca, N. Y. Nominating committee for 1911—M. L. King, Ames, Ia., H. J. Podlesak, Moline, Ill.; John Evans, Guelph, Ontario. Research committee, chairman, C. I. Gunness, of Fargo, N. D.

The Engineers' Club of St. Louis has elected the following officers for the ensuing year: President, J. D. Von Muir; vice president, A. S. Langsdorf; secretary, W. W. Horner; treasurer, William E. Rolfe; directors, William E. Zelle and Oliver W. Childs; board of managers of the association of engineering societies, John Hunter, Ernest L. Ohle and W. S. Henry.

At the annual meeting of the New England Water Works Association, held in Boston January 11, 1911, the following officers were elected: President, Allen Hazen; vice presidents, J. Waldo Smith, Leonard Metcalf, M. F. Collins, F. A. McInnes, Irving S. Wood, Morris Knowles; secretary, Willard Kent; treasurer, Lewis M. Bancroft; editor, Richard K. Hale; advertising agent, Robert J. Thomas; additional members of the executive committee, William E. Mayberry, E. A. Fisher, John J. Kirkpatrick; finance committee, George H. Finnerman, Albert L. Sawyer, John H. Walsh.

Calendar of Technical Meetings.

Nebraska Cement Association, Western Cement Exposition, Omaha, Neb. Peter Palmer, Secy., Oakland, Neb. February 1-3.

National Brick Manufacturers' Association. Annual convention, Louisville, Ky. T. A. Randall, Secy., Indianapolis, Ind. February 6-11.

Indiana Sanitary & Water Supply Association, Claypool Hotel, Indianapolis, Ind. F. C. Jordan, Secy., 113 Monument Place, Indianapolis, Ind. February 9-10.

New England Gas Association. Annual convention, Boston, Mass. W. H. Snow, Pres., Holyoke, Mass; N. W. Gifford, Secy-Treas., East Boston, Mass. February 15.

Iowa Engineering Society. Annual Meeting, Iowa City, Ia. S. M. Woodward, Secy., Iowa City. February 15-17.

Cement Products Exhibition Co., Fourth Annual Chicago Cement Show. J. U. C. McDaniel, Secy.-Treas., 108 La Salle street, Chicago, Ill. February 16- (8 p. m.) -23.

Northwestern Cement Products Association. Annual Meeting, West Hotel, Minneapolis, Minn. Harvey B. Smith, 834 Security Bank, Building, St. Paul, Minn. February 28-March 1.

Canadian Cement and Concrete Association. Annual convention, Toronto, Ont. Wm. Snaith, Secy., 57 Adelaide street, East Toronto, Ont. March 6-11.

American Railway Engineering and Maintenance of Way Association. Annual convention, Chicago, Ill. E. H. Fritch, Secy., 962 Monadnock Block, Chicago, Ill. March 21-23.

American Water Works Association. Annaul convention, Rochester, N. Y. J. M. Diven, Secy., 14 George street, Charleston, S. C. June 6-10.

Personal Notes.

Harold Doolittle has been appointed city engineer of North Yakima, Wash.

S. T. Maupin has been appointed superintendent of the water works of Knoxville, Tenn.

L. J. Klug has been put in charge of the department of bridges of the city of Milwaukee, Wis.

M. L. Worrell, at present in charge of the department of public works of Rome, Ga., has been appointed superintendent of the water works of Meridian, Miss.

Mr. Paul D. Sargent has recently resigned as state highway commissioner of Maine to accept the position of assistant director in the United States office of public roads.

J. M. Hancock, mayor of Niagara Falls, N. Y., 1902-4, will be in charge of an industrial bureau to be established by the Cliff Electrical Distributing Company, January 1, for the purpose of locating manufacturing industries at Niagara Falls.

F. W. W. Doane, C. E., city engineer of Halifax, Nova Scotia, in the presidenttial address delivered before the Nova Scotia Institute of Science, gave a very interesting discussion on technical education. This address has recently been published.

Mr. Henry B. Drowne, Assoc. M. Am. Soc. C. E., has resigned as assistant engineer to the state board of public roads of Rhode Island to accept the position of assistant engineer with Arthur H. Blanchard, consulting highway engineer, Providence.

The architectural firm of Vonnegut and Bohn, of Indianapolis, Ind., announces that Mr. Kurt Vonnegut, son of the late Bernard Vonnegut, and Mr. Otto N. Mueller, formerly chief engineer of the Noelke-Richards Iron Works, have become members of the firm.

The firm of D. C. & Wm. B. Jackson, of Boston, Mass., has been retained by the government of Great Britain to advise the postmaster general in regard to the value of the National Telephone Company, which will be taken over by the government this year and made a part of the post office system.

Dr. N. Clifford Ricker, of the department of architecture of the University of Illinois, has been appointed a member of a commission of awards, to judge and report upon the relative merits of the designs and plans submitted in competition for three department buildings to be erected in Washington, D. C.

Col. Robert F. Rodman of Lafayette, R. I., who, since 1902, has filled the office of engineer to the state board of public roads of Rhode Island, has resigned. Col. Rodman has been connected with the board since its organization and has had charge of all the work done since then. Press of business has necessitated his withdrawal.

Mr. Louis C. Kelsey, M. Am. Soc. C. E.,

of Salt Lake City, Utah, and formerly city engineer of that city, has opened an office in Portland, Ore., for the practice of engineering, dealing especially with problems of water supply, water power and municipal work. Mr. Kelsey is at present engaged in the design of water works and sewerage systems for the city of Gresham, Ore.

Louis K. Rourke, formerly street superintendent of the city of Boston, Mass., has been appointed to take charge of the street, water and engineering departments which have been consolidated under one head. J. H. Sullivan, F. A. McInnes and Frederick H. Fay will have charge of the three divisions, streets, water and sewer, and bridges and ferries, respectively.

MACHINERY AND TRADE

Concrete Finishing Tools.

Two concrete finishing tools have recently been put on the market, which are designed to cheapen and improve the usual methods of finishing.

The first of these, the Ross concrete spade, is constructed to meet the requirements of the so-called "spade finish" on wall surfaces. In such work it has heretofore been customary to deposit the concrete mixture containing stone within the form and afterward to insert a common shovel or spade between the form and the concrete, pressing the latter away from the form and at the same time supplying a liquid grouting which solidifies in contact with the face of the form, leaving a smooth even surface.

The blade of the Ross spade is designed to force the stone back from the form, leaving a space which is instantly filled by the freer cement, sand and water. A number of parallel projections are placed extending longitudinally along the blade. The height of these projections is sufficient to give a suitable thickness to the smooth surface for all requirements. The long slope of the cam projections enables the implement to be inserted easily, requiring but little power to push the stones away from the form face, and it is also but little likely to disturb them in witwhdrawing the blade. The frequency of spaces between the projections permits the flow of grouting, without causing suction upon the removal of the implement. The back of the blade is smooth so as to allow its being easily moved along the form.

The second of the implements is a tamper, the purpose of which is to aid in finishing horizontal surfaces.

According to the present practice, where a concrete floor or walk is required to have a smoothly finished top surface, the main body or layer of concrete is first laid with a mixture of stone or other aggregates, sand, cement and water, in proper proportions, and when this foundation layer has partially or wholly set, spreading thereon a surface coating or layer of sand, cement and water, richer in cement than the main body, which finished coating is smoothed off to give the required finish to the top or exposed surface. This procedure involves excessive cost, because of the larger percentage of cement required in the surface or finish coating, as compared with what is needed for strength and body alone in the first layer, and also because of the additional labor involved in making two batches of mixture and separately laying same.

The Andrews concrete tamper has a surface of eight inches, divided on its face with pyramidal projections. These projections are connected at their bases in such a way as to prevent particles becoming wedged between them. For use, after the layer of concrete has been spread and roughly leveled with the customary straight edge, the workman proceeds to tamp, with the result that the freer sand, cement and water come to the surface, leaving the latter in such a condition that it may be easily be finished without the addition of the grout mixture.

Both of these advanced concrete tools are manufactured by the Harold L. Bond Company, 383-391 Atlantic avenue, Boston, Mass.

Open Specifications.

The American Asphaltum and Rubber Co., 600 Harvester building, Chicago, Ill., have printed in a booklet with the title "Open Specifications" what they recommend for waterproof macadam roadways, asphaltic concrete pavement, brick and block pavement filler, sheet asphalt pavement, asphalt mastic floors, coating steel pipe, and waterproofing reservoirs. This document was ready for circulation at the time of the meeting in New York of the Organization of City Officials for the Standardization of Paving Specifications. It refers mainly to the Pioneer brands of asphalt, paint, etc., but very properly recommends that specifications

for such other materials as have proved their value be included for competitive purposes.

Fortunately nearly all of the specifications adopted by the above named organization were made sufficiently open to admit all these good materials, including the brands made by this company and, with but one or two exceptions the specifications open the field to the competition of all materials which have proved their value. One of these restrictions as to ductility of asphalt was unintentional and will doubtless be corrected in the specifications as printed. The specifications in the booklet omit all reference to ductility, as good results have been obtained from asphalts without reference to their possession of this quality in large or small degree.

Water Tight Sewer Joints.

The following is an extract from a letter written by W. C. Van Duyne, chief engineer of the East Orange and Ampere Land Company, which is improving the land formerly owned by the water company of Orange, N. J. It gives a bit of experience which will be interesting to many of our readers.

The system we are building at present comprises about 15,000 feet of 8 and 10-inch sanitary sewers. In making the calculations we allow for an infiltration of 33 per cent. Sulphur joints were used exclusively, and we took all precautions possible, even to coating the finished joint with cement.

The property here is that formerly owned by the Orange Water Co., and is that from which East Orange used to pump their entire water supply. Naturally the ground is very water soaked, the water table rising to within two feet of the surface in many points. Our storm sewers are as yet not completed to the point where they will reduce the water table to an appreciable amount.

About a month ago I saw I was going to have an infiltration of over 33 per cent. on the whole system. Some of our sewers were placed within six inches of quicksand. Within the last two weeks we have laid two stretches of 8-inch pipe using G-K Compound in the joints. One in a 12-foot trench and the other in a 2-foot trench. The pipe line in the 2-foot trench has been standing for a week and a half now with about one foot of water over the top of the trench. The late rains converted that section into a pond, and I have not had the water drawn off, since I wished to see what effect it would have on the sewer. As yet I have detected no infiltration. The section in the 12-foot trench is giving equally good results.

We are taking care to have the G-K compound very hot, probably 500-600 deg. F. before pouring it, as was suggested by Mr. Gillespie. We find that the joints are made more readily and that any moisture which may be in the pipe is driven out and a perfect bond made. The joints are made with much more ease than the sulphur joints are made.

Gurley's Manual.

The most recent edition, the forty-fifth, of Gurley's Manual is a compact little book of about five hundred pages. In its general features it is far superior to the previous editions. It is printed on a heavy gloss finish paper which is particularly adapted to the photographs and drawings which occupy a large proportion of the book. The illustrations of the various surveying instruments shown, are in colors so as to show the different finishes, and details of design.

Full detailed descriptions with drawings of the various instrument parts are given, together with directions for their use, adjustment and care.

The Manual is published by W. & L. E. Gurley, Troy, N. Y.

THE LUTEN TRUSS.

The Luten Truss.

The demand of engineers for a system of reinforcement for short span concrete bridges that will have the advantage of I-beam construction with low cost, has developed a number of unit trusses, among which the Luten truss has been conspicuously successful.

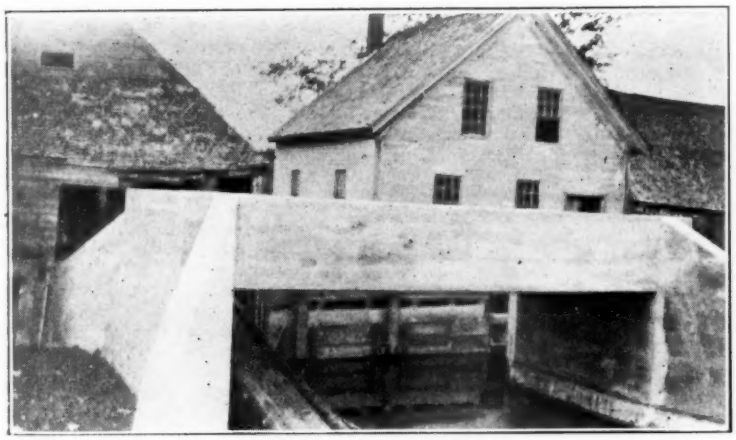
This truss as is shown in the accompanying drawing is a complete unit of reinforcement. It is shipped from the factory in exactly the form as shown. This feature does away with the danger which results from the ignorant or careless placing of the reinforcement. To one familiar with the principles involved in the computing of stresses in reinforcement and the value of accurate observance of the features of design, the value of this feature of the Luten truss will be at once apparent.

The reinforcement consists of a number of steel rods or bars to be embedded near the lower edge of the beam with alternate members bent diagonally upwards across the beam to continue along the upper surface to its ends. The points at which the

curved members are bent across the beam are displaced with respect to one another so as to provide diagonal reinforcement through the regions of diagnonal tension and of shear in both ends of the beam. By varying the number of bars composing the truss from three to nine or more, any desired degree of reinforcement may be given to the tension regions or shearing regions of the beam, thus reinforcing efficiently beams that are comparatively deep, as well as beams or floors that are shallow. All members are curved at their ends to form a secure anchorage. The bars are rigidly locked together to form the truss by a clamp with a wedge that is self-locking when driven home. This clamp makes of the truss a unit reinforcement that can be transported and placed with no possibility of the bars losing their proper relative positions.

The truss has been extensively used in the Central States for highway bridges of spans from 5 feet to 24 feet in the clear. It has also been used by electric railways and some steam lines.

The photograph shows a new bridge on the new Portland Gray & Lewiston electric railway in Maine. The National Concrete Company of Indianapolis, Ind., are the manufacturers of this truss, and will furnish further information upon application.



INTERURBAN BRIDGE
Portland, Gray & Lewiston R. R., Maine.

A Power Tamping Machine.

A machine which has proved its worth by several years' practical service is the Staley power tamping machine, manufactured by R. U. Staley, Springfield, Ill. A number of minor modifications have been made in the machine, but it remains essentially the same as the original.

The machine consists of two principal parts, a two wheeled truck built of steel, properly braced and with the necessary handles conveniently placed for the operator; on the truck axle is placed the pivot bearing on which is mounted the sweep. The sweep is made up of two 3-inch steel channels mounted on a saddle. Near the center the saddle is supported on the pivot, bearing on truck axle; the rear end of sweep has a sliding bearing on and is yoked to a cross member of the truck. Near the rear end of the sweep are placed the air-cooled gasoline engine, battery box and gasoline tank. At the front end of the sweep is placed the lifting mechanism, which consists of two lifting rolls, mounted on shafts, running in bearings bolted to the steel channels; the lifting rolls are geared together by gears of equal size and are driven by a pulley, shaft and pinion, gearing into one of the larger gears. The tamp is a cast-iron head and a hardwood lifting board; the lifting board slides in steel guides riveted and braced to the steel channels. The fall of the tamp is by gravity; the length of the stroke, also the time of the rise and release of the tamp, is automatically regulated by cutting away a part of the circumference of the lifting rolls, the tamp making one stroke to each revolution of the lifting rolls. The bearings of the lifting rolls are tied together by steel rods, which take the strain; the front roll is pressed against the lifting board by coil springs on the tie rods. The upward movement of the lifting board is limited by reducing the thickness of the board at the lower end, which prevents the rolls lifting it above a fixed point; the fall of the tamp is stopped by releasing a pair of cams or dogs, which grip the board and prevent it falling, but allow

the lifting rolls to run it to the upper position where it remains until released by the operator through a small lever placed near his right hand.

The machine has "made good" in all sorts of trench work.. Its value and economy may be judged from the following facts:

At 60 blows per minute, and an 8-hour day, the machine delivers 28,800 blows. Subtract 3,800 for lost time, leaving 25,000 delivered on the work. With a tamping head of one-half square foot in area, this is 12,500 square feet per day. On a trench 3 feet wide and 5 feet deep, tamped up in 8-inch layers, this would mean about 700 linear feet of trench per day.

Pile Driving by Steam or Compressed Air.

The Union Iron Works, of Hoboken, N. J., is manufacturing a very efficient type of pile driver known as the Arnott patent. The superiority of the steam or air hammer over the old-style drop hammer is generally recognized. Although it gives a lighter blow, the steam hammer follows up its blows so rapidly that the pile and the ground have no time to settle back into their normal static condition before the next blow. This well-known fact is the root of the reason for the superior effectiveness of the steam hammer, while the fact that the light blow does not split the pile head gives it additional advantage.

The Arnott patent herein described has been designed to place in the hands of engineers and contractors a simple and powerful means for driving piles of all kinds. The principle of operation is the alternate rapidly raising and driving down of a ram of considerable weight by compressed air or steam.

The hammer is a plain cast-iron body, with a cylinder and valve chest in its upper portion, enclosing the ram and valve rod below. The opening is formed at the bottom, with jaws to fit over the top of the wood or steel piling, or with a removable base for round piling. The jaws permit the insertion of pile caps for all makes of steel piling.

The operation of the hammer is as follows:

On opening the inlet valve or throttle, steam or compressed air is admitted to the lower end of the cylinder, raising the ram to the top of its stroke; the valve is actuated by a rod, and steam or air is turned into the upper end of the cylinder, and the lower end open to exhaust, the free fall of the ram being thus accelerated by the steam or air pressure on the back of the piston; the force of the blow is therefore correspondingly increased. On the down stroke, when the ram strikes the pile, the valve is reversed by the rod, and the ram raised as before, and so on in rapid succession. The whole construction of the hammer is solid, simple and self-contained throughout.

Immersion Process for Preserving Wood.

The Cincinnati Wood Preserving Company, a corporation of Cincinnati, O., is operating a wood preserving plant in that city, using Indian timberasphalt as the preserving medium. They use the immersion process and claim to obtain results on all structural timbers very nearly equivalent to those secured in the pressure process.

The plant is designed for the purpose of treating railway ties, flooring, bridge and mine timbers, fence posts, cross-arms, paving blocks, shingles, etc., their capacity being about 12,000 ties, or 36,000 b. m. ft. of lumber per month.

The success of their process is largely in the substitution of the element of time, so valuable to the output of expensive pressure plants, for pressure. Their treatment consists of heating the timber in the timberasphalt above the boiling point of water for 12 hours, in this way expelling the moisture and sap content and expanding the air which is always present in the cellular spaces of the wood. The preservative is then allowed to cool over night, the final temperature being considerably lower than the initial high temperature of the boiling process. As the oil cools the air content and the cellular structure of the timber contract, a vacuum is formed in the cells and atmospheric pressure forces the oil into the wood.

Heretofore this immersion process has not largely been used because the preserving medium was generally the expensive creosote, a large percentage of which evaporated into the air when exposed to atmospheric conditions. Timberasphalt does not evaporate, is much cheaper than creosote. Hence, timbers may be successfully treated by this process at low expense with the first cost of plant erection reduced to a minimum.

Cement Composite Pipe.

The demand for a pipe which will withstand electrolytic and chemical action has led to the manufacture of a cement composite pipe which, by slight modifications, may be adapted to a number of uses. The Composite Pipe Company, of Mansfield, Mass., is manufacturing a number of types of this sort of pipe.

One of these types, the composite hydraulic pipe, is made in the ordinary bell and spigot form. This pipe is machine-made of a mortar of one part of sand to one part Portland cement, thoroughly compacted. The outer shell of this pipe is of metal, inside of which is a layer of cement, then another metal shell and an inner lining of cement. This lining is made of glasslike smoothness, so as to offer a low friction resistance, while its character assures against corrosion and rust. The shell is welded at the ends to cast steel pieces, which form the joints and allow the pipe to be calked

like the ordinary cast iron. The cost of this pipe is but little in excess of cast iron, and it will stand an hydraulic pressure of 300 pounds per square inch. The pipes are made in 12-foot lengths and may be shipped the same as the cast iron.

In addition to this type a number of different kinds of pipe are made by this company, and a number of patented non-electrolysis joints are provided.

Some data have been taken regarding the length of life of cement pipe, and cases are recorded in which it has been in the ground for over sixty years. This 263 Summer st., Boston, Mass.
was the old style pipe made from Rosendale cement, plastered by hand. By the new process, involving the more perfect compacting of the Portland cement now used, the life of the composite pipe should prove much longer.

History of the Quenner Dry Crusher.

In the northwestern part of Mexico, in the district of Altas, State of Sonora, is a belt of auriferous cement placer ground, containing hundreds of millions of dollars of gold. For centuries this gold has been taken out by the Mexicans and Indians in very small quantities by hand work. The native method employed was to take ordinary flails, mortars or pestles, grind up a small part of the cement, use the ordinary "batea," or dry pan, and take out gold equivalent to perhaps a very low day's wage.

One of our greatest railroad men in the southwest, learning of these rich cement, gold-bearing areas, secured the capital, organized a company, built a large stamp mill, a pipe line sixteen miles in length, pumping plants—in fact, a splendid mining plant, all designed by experts, to take out in enormous quantities this gold.

The plant being completed, they started their initial work, ran several months, and never took out a spoonful of gold.

An old blacksmith, 70 years old, Mitt Quenner by name, saw the failure—in fact, was associated in a sense with it—and when this placer ground was finally given up and abandoned by the big mining company, he quietly set to work and built with his own hands a little revolving cage or screen, about 5 feet long and 42 inches in diameter, which might be compared to a long barrel with iron staves placed about ⅛ inch apart. Through the length of this barrel ran a shaft. The barrel itself rested on trommel wheels. A gasoline engine furnished the motive power. Ordinary steel crowbars were cut up to forge out the steel striking pins or hammers; an old log chain furnished the links which were attached to the hammers, and then clamped onto the shaft spirally, all this work being done by the old blacksmith himself, with his own hands. Finally, this crude machine was started, the forerunner of the Quenner machine of to-day. The first day's run he took out in pure gold $500. The succeeding nine months he took out $180,000 in nuggets, and then the fame of the Quenner machine began to spread.

About ten months ago R. P. Probasco casually met Mr. George D. Stonestreet, an eminent mining enineer of New York City, at the railroad station of Santa Ana, on the line of the new Southern Pacific Railroad, in western Mexico, and was invited to accompany him to see the new and wonderful Quenner machine. Riding fifty-five miles by stage, they came to Baludo, where the original Quenner machine had been in daily, constant operation during the previous nine months, with unvarying success and great profit to its inventor and owner. They watched its perfect action with intense interest. They noted the perfect character of the work it was doing, and contrasted it with the absolute failure of the million-dollar modern stamp mill, standing, silent and deserted, but a few rods away. The contrast was a painful one, from a certain standpoint, showing the slow progress by which humanity works out its evolution of mechanical processes. They further noted the enormous deposits of stone, crushed to perfect sizes, a mountain of rubble, which would have been worth a large sum if it could have been utilized anywhere for ballast or concrete work, and the idea at once occurred to Mr. Stonestreet of the immense value of this machine for crushing stone.

With the initiative and executive energy for which he is noted, Captain Stonestreet immediately returned to New York, enlisted capital, returned to Mexico and secured the control of the Quenner machine and patents for the world. Tests were soon thereafter made by prominent railroad officials at Nogales, Ariz., in which surprising facts were developed concerning the capacity of this machine for crushing refractory materials at low cost. Succeeding tests were made of the Quenner machine at Los Angeles.

The "Quenner" will be applied to effect great economies in all crushing operations. It should save many tens of millions of dollars annually in the crushing of over 500,000,000 tons of refractory materials in the United States alone. As to its world-wide application, that will surely come in due time.

Good roads mean everything to a country. The roads of continental Europe are marvelous. We lose fifties and even hundreds of millions annually in the United States by reason of poor roads, and the Quenner machine will aid in solving the problem of good roads making, not only by reason of its crushing rock cheaply, but by reason of its portability and adaptability to all local conditions wherever used. Thus poor roads can be rebuilt and made over into good roads, the

cost of which would otherwise be prohibitive for the local communities.

The Quenner machine, weighing only four tons, does the work of the average 48-ton standard type crusher. An ordinary truck will haul it. It can be taken along a country road on ordinary trucks. It can be hauled into a quarry. It has the most numerous and adaptable uses, as well as reducing costs.

The Quenner machine now has its headquarters in the Singer building, New York City.

Trade Publications.

The January publication of the Lehigh Portland Cement Co. contains a complete description of the King's Creek Power Station at King's Creek, South Carolina, with photographs of various details of the work.

The Studebaker Co., of South Bend, have issued a very attractive illustrated booklet showing various details of their factory and a number of their saleshouses in various cities.

An unusually artistic booklet is offered by the Union Clay Products Co. of New York. This booklet describes the advantages of the G-K sewer joint compound. A table of quantities of compound per joint should prove of value.

The Weber Chimney Company, Republic Bldg., Chicago, have a valuable booklet on reinforced concrete chimney construction. Illustrations and drawings are given very freely.

Farmers Bulletin 321 of the U. S. Department of Agriculture is devoted to the use of the split log drag on earth roads. The paper is by D. Ward King, of the office of public roads.

Winnipeg Illustrated is the title of a well conceived and executed publication of views and data relative to the city of Winnipeg. Care is shown in the character of the matter used, to give an idea of the industrial as well as the ornamental features of the city.

The annual report of the Massachusetts State Board of Trade contains a number of committee reports and discussions which should prove of value.

The Economy Drawing Table Co., Chamber of Commerce Building, Chicago, have published a book of photographs and descriptive matter on Wisconsin granites. Specifications for granite curbs and pavements are also included in the publication.

"Reactions," the quarterly publication of the Goldschmidt Thermit Co., 90 West street, New York City, contains, among other subjects of interest, a number of photographs with descriptive matter relative to rail welding in various cities.

The Vulcanite Portland Cement Co. have two booklets which are up to the usual standard of excellence of the publications of that company. The first of these, entitled Concrete in the Country, is descriptive of the numerous uses of cement on the farm. The second is Concrete Surface Finishes, by Albert Moyer. Both publications are fully illustrated, the latter named having color plates which bring out the effects of the different color finishes.

Reinforced concrete fence posts are described in an illustrated pamphlet by The Everlasting Fence Post Co. of Bloomington, Ill.

The Trussed Concrete Steel Co. of Detroit, Mich., have a new illustrated catalogue of their United Steel Sash. The standard types of United Steel Sash are shown, as well as complete tables of dimensions and full-sized details at the lintels, sills and jambs.

The Pittsburg Steel Products Co. have some very valuable matter for distribution. This matter includes the design of a typical concrete warehouse of three floors, giving the computations necessary; descriptions and specifications of Pittsburg standardized reinforcement, and a complete set of specifications for reinforced concrete construction.

The Aberthaw Construction Co., of Boston, Mass., have an illustrated publication concerning the design and construction of a concrete warehouse for the Massachusetts Cotton Mills at Lowell, Mass.

Among the features of interest in the monthly publication of the Universal Portland Cement Co. is a short article on the use of concrete in the Chicago city parks. "The Interlocking Tube System of Construction," and "A Reinforced Concrete Building Under Fire," are among other illustrated articles given.

The Troy Wagon Works Co. of Troy, O., has three very attractive pamphlets. The first of these is descriptive of the Troy dump wagons for municipal uses; a photograph illustrates the points of the description. The second is devoted to specifications and illustrations of the Troy dump wagons. The third deals iwth the Troy dump boxes.

The Barber Asphalt Paving Co. has a series of photographic postals dealing with roads constructed with Bermudez asphalt.

"Yourself as a Public Servant" is a leaflet written by Arthur S. Huey and issued by H. M. Byllesby & Co., engineers and managers of public utilities.

"Designing Data II" by the North-Western Expanded Metal Co., of Chicago, will be found of value in the design of all engineering structures excepting buildings. The latter will be found in "Designing Data I" by the above mentioned company.

"Motor Fire Apparatus" is the title of a fifty page illustrated book of the Webb Motor Fire Apparatus Co., of St. Louis, Mo. About ten different types of motor apparatus are described and illustrated.

The Meriwether system of continuous reinforced pipe is fully covered in an

illustrated catalogue issued by the Lock Joint Pipe Co., of 165 Broadway, N. Y.

Examples of the use of and points of value in Texaco Paving Cement are given in an illustrated booklet by the Texas Company of Houston, Tex.

Trade Notes.

CEMENT.

Chicago, Ill.—After a severe test, McCormick Waterproof, manufactured by the McCormick Portland Cement Co., St. Louis, has been specified for use in waterproofing over 40,000 barrels of cement to be used in the La Salle street, Chicago, Illinois, subway, 60 feet below the Chicago river; pressure test, 400 pounds per sq. in. without leakage or evidence of penetration after test pieces were broken.

Sandusky, O.—The Medusa Concrete Waterproofing Co. has announced its intention to prosecute all infringers of their patents on dry powder waterproofing compounds, the purposes of which are to render concrete impervious to water. These patents are to S. B. Newberry, issued April 23, 1907, and to H. N. Newberry, issued September 15, 1908.

PURCHASE OF MATERIALS.

Washington, D. C.—The Bureau of Manufactures received a letter from Cuba, requesting correspondence from manufacturers of garbage disposal plants and machinery.

Southbury, (Newton P. O.) Conn.—The town is contemplating the purchase of a road machine.

Washington, D. C.—The Bureau of Manufactures wishes catalogues, prices, etc., on steam rollers and road machinery for use in Spain.

Butte, Mont.—The city is contemplating the purchase of a rock crusher.

Taylor, Tex.—The city is considering the purchase of a road roller for use in paving improvements.

MACHINERY AND SUPPLIES.

Sacramento, Cal.—Special—Clark & Henry Construction Co., 512-516 Ochsner Bldg. are in the market for machinery for unloading rock from cars.

Garrett, Ind.—Special—J. O. Landes, 317 Randolph st. desires to purchase an excavator.

Lyons, Ind.—Special—Fred Carpenter is in the market for a trench ditcher and road tools.

Boston, Mass.—Special—Bids are requested for furnishing 25 h. p. hoisting engine and a Haywood ½ yd. bucket. Peter F. Connolly Co., 70 Perkins st., Jamaica Plains, Boston, Mass.

Canton, O.—Bids will be received for two steam road rollers. Phil H. Weber, cy. civil engr.

New Philadelphia, O.—Bids are requested for cement mixer and road roller by H. P. Knisley.

Youngstown, O.—Special—W. E. Gartland, 414 Ford ave. desires to purchase a ditch digger and sewer machinery.

Salem, Ore.—Special—D. M. Stevenson, Box 52, is in the market for electric rock drills.

Ingram, Wis.—Special—Seward J. Wilbert desires to purchase an air cooled gasoline engine.

South Milwaukee, Wis.—Special—Bids are requested for a drag line excavator by J. H. Whalen.

Millville, Sask., Can.—Special—A. B. A. Cunningham is in the market for cement mixers.

MISCELLANEOUS.

Chicago, Ill.—Bates & Rogers Construction Co., civil engineers and contractors, announce the removal of their Chicago offices, on January 21, 1911, from the Ellsworth building to No. 885 Old Colony building, No. 84 Van Buren street, Chicago. Bates & Rogers Construction Co. are equipped with organization and plant to undertake all classes of construction, including stone masonry, reinforced or massive concrete work, dams, retaining walls, bridges, arches, culverts, foundations, irrigation and hydro-electric power developments, massive building work, pile and timber work, and all classes of railroad construction.

New York.—The Michel-Kurze Co., with offices in the Hudson Terminal buildings, New York, has been organized to do photo retouching and illustrating work of machinery subjects. The business will be managed by A. Eugene Michel, Assoc. Mem. Am. Soc. M. E. and the staff of artists will be in charge of Wm. F. Kurze, who was art director of the Scientific Engraving Co. during the past four years. The extensive engineering and advertising experience of both members qualifies this firm to deliver high grade work to manufacturers of machine tools, steam and electric power plant apparatus and other engineering products.

Walla Walla, Wash.—Gilbert Hunt Co., Walla Walla, has been awarded by its home city a contract for 6,000 feet of 20-inch riveted steel pipe; the price was 97½ cents per foot. This company is unusually well equipped to make a specialty of riveted pipe work.

Patents on Concrete Articles.

859,418. Cement Closet Tank. Joseph A. Washick, Chicago, Ill.

864,022. Facing for Embankments, Dams and the Like. Robert R. L. de Muralt, Zierikzee, Netherlands.

874,922. Vault Light Construction. Julius Baker, Allegheny, Pa.

882,538. Plastic (cement receptacles). Allston Sargent, New York, N. Y.

885,281. Land-Marking Monument (concrete). Robert L. Packard, Tuckahoe, N. Y.

890,968. Process of Treating and Dressing a Bruise or Wound in the Trunk or Branch of a Live Tree (cement). John, Martin L., and James A. Davy, Kent, O.

891,998. Concrete Manifold System. Gerald W. Knight, Pittsburg, Pa.

900,980. Casket Protector. Eugene J. Callahan and Daniel G. Fisher, Reading, Pa.

906,195. Stay or Support with Steps for Producing Concrete Ceilings. Christian Buerker, Josef and Jean Klee, Cologne, Germany.

906,493. Mold Panel. Deith O. Guthrie, New York, N. Y.

915,698. Means for Making Cement Head Gates. Thos. Putz, Porterville, Cal.

918,241. Apparatus for Forming Headstone from Plastic Material. Christopher C. Wingo, Baltimore, Md.

922,651. Apparatus for Forming Cement Boxes. Thos. H. Williams, Utica, Ill.

924,549. Concrete Plant-Protector. Jas. H. Haley, Munith, Mich.

924,704. Machine for Polishing Stone and Concrete Floors. Frank O. Street and L. J. Larson, Minneapolis, Minn.

925,948. Concrete Hog Trough and Valve. Jeremy Robertson, Shelby, Ia.

925,964. Concrete Car. Joseph B. Strauss, Chicago, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Birmingham, Ala.—Contemplating the laying of 24,700 sq. yds. of asphalt and 1,800 sq. yds. of macadam paving.

Phoenix, Ariz.—Contemplating the laying of 5 miles of bitulithic and 5 miles of oiled macadam pavement. O. A. Turney, cy. engr.

Los Angeles, Cal.—The grading, paving and constructing concrete culverts on the valley road from Whittier to Forthill blvd. in Lamanda Park is contemplated.

Modesto, Cal.—Paving of various streets is contemplated.

Redondo Beach, Cal.—The paving of Hermosa, North Pacific, North and South Guadalupe aves. is contemplated.

Santa Ana, Cal.—The construction of 127 miles of roads is contemplated.

Upland, Cal.—Bids will soon be asked for paving 10th st.

Hartford, Conn.—The paving of Sheldon st. and Farmington ave. is contemplated.

Altapass, Ga.—The construction of a macadamized road from Asheville, N. C., to Altapass, Ga., is contemplated.

Freeport, Ill.—Two miles of brick paving is contemplated.

Peoria, Ill.—Paving with brick portions of Elizabeth and South sts. is contemplated. Estimated cost, $45,334.

Sterling, Ill.—Voted $40,000 bonds for paving Locust st. with brick.

Indianapolis, Ind.—The construction of a boulevard along Pleasant Run from Beecher to Shelby sts. is contemplated.

Laporte, Ind.—Contemplating the construction of a macadam road from Laporte, to the Starke county line.

Richmond, Ind.—Contemplating the paving of various streets.

South Bend, Ind.—Paving about 30,000 sq. yds. on Michigan st. is contemplated.

Corning, Ia.—Paving of the following streets is contemplated: Davis ave. from the railroad right of way to the north line of 9th st., and 8th st. from the alley between Davis ave. and Adams st. to Grove ave. in the city of Corning, Ia.

Des Moines, Ia.—Contemplating the paving of various streets with sheet asphalt and creosote blocks.

Mason City, Ia.—Plans are being prepared for concrete paving.

Topeka, Kan.—The paving of portions of 14th, Huntoon, Polk, 12th and Chandler sts. with brick, and 13th, Mulvane and King sts. with asphaltic concrete, is contemplated.

St. Joseph, Mo.—Laying asphalt coating on 6th and Atchison sts. to the viaduct, is contemplated.

Kearney, Neb.—Contemplating the construction of a road across Buffalo county.

Red Oak, Neb.—Contemplating the paving of 32 blocks.

Rochester, N. Y.—The paving of St. Paul st., is contemplated.

St. Johnsville, N. Y.—Brick paving to cost $36,000 is contemplated.

Akron, O.—Ordinances have been passed providing for the grading, curbing and paving of various streets.

Canton, O.—Ordinances have been passed authorizing the grading, curbing and paving with vitrified paving blocks, various streets.

Cleveland, O.—The paving of 33 streets estimated to cost $600,000, is contemplated.

Columbus, O.—Ordinances have been passed providing for the improvement of various streets.

Dayton, O.—The paving of Britt st. and Santa Clara ave., is contemplated.

Hood River, Ore.—Contemplating the construction of macadam paving, curb and sidewalks to cost $10,000.

Silverton, Ore.—The county court has issued an order for the construction of the Silverton-Marquam macadam road.

Blairsville, Pa.—An ordinance was passed to grade Liberty st. north of Campbell st., to North alley.

Danville, Pa.—An ordinance has been passed providing for the grading, paving with vitrified paving bricks and curbing with stone, various streets.

Sharpsville, Pa.—Contemplating paving about 25,000 sq. yds. with brick, during the present year.

Wilkesbarre, Pa.—An ordinance has been passed authorizing the grading, curbing and paving of Park ave.

Centralia, Wash.—The paving of 10 blocks is contemplated.

North Yakima, Wash.—Asphalt paving amounting to about $400,000 is contemplated.

Puyallup, Wash. — Paving various streets is contemplated.

Seattle, Wash.—Paving and laying sidewalks on various streets is contemplated.

CONTRACTS TO BE LET.

Mobile, Ala.—Bids will be received until Feb. 16 for constructing cement street paving, approximating 11,400 sq. yds., 8,400 lin. ft. curb, 1,000 lin. ft. of vitrified sewer pipe, etc. Board of public works.

Palatka, Fla.—Bids will be received until Feb. 7, 7:30 p. m., for constructing 16,500 sq. yds. of concrete sidewalks. Certified check, $500. City council, Palatka, Fla.

Tampa, Fla.—Bids will be received until Feb. 7, 2 p. m., for paving 1½ miles of roadway southward from six mile creek, with shell. Geo. P. Sullivan, cy. engr.

Atlanta, Ga.—Bids will be received until Feb. 6 for furnishing and setting concrete and granite curbing, laying brick, tile and sheet cement sidewalks, etc. J. P. Foster, cy. clk.

Bloomfield, Ind.—Bids will be received until Feb. 7 for macadamizing the W. W. Clogston road in Washington township. Caswell H. Jennings, audt.

Brazil, Ind.—Bids will be received until Feb. 7, 11:30, for constructing gravel road in Van Buren township. E. A. Staggs, audt.

Crawfordsville, Ind.—Bids will be re-

ceived until Feb. 7, 2 p. m., for constructing a road in Union township. Bennett B. Engle, audt.

Evansville, Ind.—Bids will be received until Feb. 9 for furnishing gravel and rock, for road construction. County auditor.

Fort Wayne, Ind.—Bids will be received until Feb. 2, 10 a. m., for grading, graveling and macadamizing various highways. C. H. Brown, co. audt.

Frankfort, Ind.—Bids will be received until Feb. 11, 1 p. m., for constructing a gravel road on line between Clinton and Tippecanoe counties. Chas. F. Cromwell, audt.

Franklin, Ind.—Bids will be received until Feb. 18 for constructing a highway on the line dividing Johnson and Shelby counties. Wm. B. Jennings, audt.

Indianapolis, Ind.—Bids will be received until Feb. 3, 10 a. m., for the improvement of Sanborn st. from south curb line of New York st. to north property line of Owosso ave. Board of public works.

Logansport, Ind.—Bids will be received until Feb. 7, 10 a. m., for constructing a gravel road in Tipton township. J. E. Wallace, audt.

Mt. Vernon, Ind.—Bids will be received until Feb. 8 for constructing gravel road in Robb township. Paul Maier, audt.

Portland, Ind.—Bids will be asked until March 1, 12 m., for constructing a road on line beteewn Jay and Randolph counties. W. Lea Smith, audt.

Rushville, Ind.—Bids will be received until Feb. 7, 2 p. m., for constructing a macadam road in Ripley township. Jesse M. Stone, audt.

Tipton, Ind.—Bids will be received until Feb. 6, 10 a. m., for constructing six gravel roads. J. H. Tranborger, audt.

Winamac, Ind.—Bids will be received until Feb. 7, 2 p. m., for constructing 3 gravel roads. W. E. Munchenburg, audt.

Manhattan, Kan.—Bids will be received until Feb. 7, for paving with brick block, wood block, concrete, asphaltic concrete or sheet asphalt pavement various streets. Certified check $1,000. C. T. Gist, clk.

Boston, Mass.—Bids will be received until Feb. 20 for constructing roads, walks and drains at Fort Andrews, Boston Harbor, Mass. Capt. A. M. Miller,

Menominee, Mich.—Bids will be received until Feb. 14, 2 p. m., for constructing a gravel road. County commissioners. Carl A. Anderson, clk.

St. Paul, Minn.—Bids will be received until Feb. 6 for constructing several roads. Geo. J. Ries, audt.

Warren, Minn.—Bids will be received until Feb. 4 for furnishing the following: 25 culverts of 3 ft. diameter; 25 culverts of 4 ft. diameter; 35 culverts of 5 ft. diameter; 15 culverts of 6 ft. diameter. Certified check 10 per cent. County auditor, Marshall Co., Warren, Minn.

Buffalo, N. Y.—Bids will be received until Feb. 6 for repaving Elk and Sycamore sts. and for paving Milton, Sanford and Krupp sts. Francis G. Ward, chairman public works.

Newburgh, N. Y.—Bids will be received until Feb. 7 for paving portions of Grand st. D. J. Coutant, cy. clk.

Cincinnati, O.—Bids will be received until Feb. 3 for constructing culverts on the Kirby road. Fred Dreihs, clk.

Cincinnati, O.—Bids will be received until Feb. 3 for constructing culverts on Kirby road, through lands of Ungruhes and Kirby, in Mill township. Fred Dreihs, clk.

Cleveland, O.—Bids will be received until Feb. 8, for grading, draining and improving Union road. Board of County Commissioners. John F. Goldenbogen, clk.

Portland, Ore.—Bids will be received until Feb. 23 for constructing pavement on Jersey st. J. W. Morris, cy. engr.

St. John, Ore.—Bids will be received until Feb. 23 for hard surface pavement on 13 blocks on Jersey st. Cy clk.

Erie, Pa.—Bids will be received until Feb. 13, 8 p. m., for paving a portion of W. 29th st. F. Hanlon, cy. clk.

Pittsburg, Pa.—Bids will be asked until Feb. 6, 3 p. m., for grading, curbing and paving Goldbach Way, from Brownsville road to Amanada ave. Certified check $200. Borough council, Brownsville Road, Pittsburg, Pa.

Waterville, Wash.—Bids will be received until Feb. 7 for constructing a macadam highway 8 miles in length. Board of supervisors.

Huntington, W. Va.—Bids will be received until Feb. 6, for grading and paving with vitrified brick, bitulithic, sheet asphalt, asphalt block or concrete asphalt. Board of commissioners.

Huntington, W. Va.—Bids will be received until Feb. 20, 1 p. m., for paving alley between Third and Fourth avenues, from Sixth to Eighth streets. John Coon, commr. of streets.

Milwaukee, Wis.—Bids are requested for sand and gravel loading device. Geo. J. Markey, 1150 Kinnickinnic ave., Milwaukee, Wis.

Vancouver, B. C.—Bids will be received until Feb. 7, for supplying road rollers, weighing not less than 16 tons. City clerk.

Winnipeg, Man., Can.—Bids will be received until March 1, for supplying about 1,500 tons of asphalt for street paving. Board of control, M. Peterson, secy.

CONTRACTS AWARDED.

Birmingham, Ala.—The contract for laying granitoid pavement on ave. B, from 18th to 20th sts., and on D ave. from 18th to 21st sts., was awarded to McCartin Construction & Contracting Co., Birmingham, Ala., $25,456.

Chico, Cal.—The contract for grading and graveling various streets was awarded to Chico Construction Co., Chico, Cal., for $32,000.

Corona, Cal.—The contract for paving Rimpan st. was awarded to Enos Bruckman & Kroonen, San Diego, Ca., for $20,283.

Coronado, Cal.—The contract for improving A, B and C aves. was awarded to H. G. Fenton, Coronado, Cal., $59,275.

Inglewood, Cal.—The contract for improving Commercial st., grading, graveling, cement curbs and gutters, etc., was awarded to G. H. Oswald, Los Angeles, Cal.

Lankershim, Cal.—The contract for constructing and paving boulevard 1½ miles in length, was awarded to Barber Asphale Paving Co., Central Bldg., Los Angeles, Cal.

Los Angeles, Cal.—The following contracts were awarded: Improving Sutherland st. by grading, graveling, cement curbs and gutters, etc., to Withers & Crites, Los Angeles, Cal., $5,831; constructing Valley road from Downey to American avenues near Long Beach, to Geo. A. Rodgers, Los Angeles, Cal.; improving Hartford ave., to B. C. Nichols, Los Angeles, Cal.; the following street improvements: Blanchard and Cincinnati sts., to H. H. Curtis, Los Angeles, Cal.; Center st., to B. F. Ford, Los Angeles, Cal.; Francis and Normandie aves.,

to David Joy, Los Angeles, Cal.; constructing 28,000 sq. ft. of cement sidewalks and 8,000 ft. of cement curbing, to Paonessa & Taylor, Los Angeles, Cal.; paving Evergreen ave., to Frank Gillespie, Los Angeles, Cal., $13,206.

Ocean Park, Cal.—The contract for improving Waldo st., was awarded to Jos. G. Braun, Ocean Park, Cal.

San Bernardino, Cal.—The contract for improving E st., was awarded to Ernest Frenzell, San Bernardino, Cal., $10,000.

San Francisco, Cal.—The following contracts were awarded: Grading Beale st. between Folsom and Bryant sts., to Foster Vogt, San Francisco, Cal., $55,805; substituting asphalt for basalt blocks on O'Farrell st., to City Improvement Co., San Francisco, Cal., $12,050.

Sierra Madre, Cal.—The contract for improving Windsor lane was awarded to G. H. Curtis, Los Angeles, Cal.

Stockton, Cal.—The contract for paving nine streets with macadam was awarded to O. Moreing & Sons, Stockton, Cal.

Woodland, Cal.—The contract for constructing 6,152 ft. of macadam on Ann st., was awarded to Jos. Lawrence, Woodland, Cal.

Denver, Colo.—The contract for grading streets and constructing concrete curb and gutter in East Denver, was awarded to Westcott Doan Investment Co., Denver, Colo., $45,515.

Washington, D. C.—The contract for grading Kearney st. was awarded to E. G. Gummel, Washington, D. C.

St. Petersburg, Fla.—The contract for grading and paving 2nd st. was awarded to Georgia Engineering Co., Augusta, Ga.

Carlyle, Ill.—The contract for grading the roads in the township and keeping them in repair for the ensuing year, was awarded to Sam Cox, Arcola, Ill.

Chicago, Ill.—The following contracts were awarded: Paving as follows: alley, 47th st. to 48th st., Michigan ave., and Indiana ave., to F. K. Shobe Co., 524 W. 63rd st.; alley, 37th st., 38th st., State st. and Dearborn st.; alleys between 26th st. and 28th st., Michigan ave. and Wabash ave.; alley between 42nd st., 43rd st., Evans ave. and Cottage Grove ave.; alley between 42nd st. and 43rd st., Langley ave., and Evans ave.; alleys between 41st st., 42nd Pl., Drexel blvd. and Ellis ave.; alley between 42nd Pl., 43rd st., Ellis ave. and Berkeley ave.; and alley between Bowen ave., 42nd st., Vincennes ave. and St. Lawrence ave., to John A. McGarry & Co., 1001 Security bldg.; alley between 35th st., 37th st., Grand blvd. and Vernon ave., to Parker Washington Co., 920 Chamber of Commerce bldg.; alley between 21st st., 22nd st., Prairie ave. and Indiana ave.; alley between Woodlawn ave., Lake ave. and E. 46th st., to Jno. A. McGarry & Co., 1001 Security bldg.; S. Center ave., W. 21st st. to W. 22nd st., Cullom ave., N. Clark st., to N. Ashland ave., Evans ave., 43rd st. to 47th st., to R. F. Conway, 720 Chamber of Commerce; N. 41st st., Hirsch st. to W. North ave., to Standard Paving Co., W. 50th st.; Ashland ave. and Robey st., Ready & Callahan Co., 47th st. and Halsted st.; W. 52nd st., Loomis st. to Ashland ave., to R. F. Conway Co., 720 Chamber of Commerce; N. Hamlin ave., Dickens ave. to Fullerton ave., Standard Paving Co.; Ellen st. system to Jas. A. Sackley Co., 307 Chamber of Commerce; alley between Hyde Park Blvd., Woodlawn ave. and E. 52nd st. to Jno. A. McGarry Co., 1001 Security Bldg.; N. Campbell ave., Austin ave. to Grand ave., R. F. Conway Co., 720 Chamber of Commerce; W. 53rd st., S. Ashland ave. to S. Robey st., R. F. Conway Co., 702 Chamber of Commerce.

East St. Louis, Ill.—The contract for paving various streets with brick, was awarded to Meyer & Thomas, East St. Louis, Ill., $24,540.

Glencoe, Ill.—The contract for paving with macadam 21,140 sq. yds., was awarded to John A. McGarry & Co., Security Bldg., Chicago, Ill.

Rock Island, Ill.—The contract for paving 38th st. with brick was awarded to Northwestern Construction Co., Davenport, Ia., $51,000.

Bluffton, Ind.—The following contracts were awarded: Constructing various gravel roads to Wilson A. Woodrow, Ossian, Ind., and C. W. Worth, Bluffton, Ind. Total cost, $14,999. Constructing stone and gravel roads, to W. W. Woodward, Ossian, Ind.; Williams road, to Chas. North, Bluffton, Ind.

Covington, Ind.—The contract for constructing county line gravel road, was awarded to Fred Cunningham, Bloomfield, Ind., $10,480.

Huntington, Ind.—The contract for constructing Thomas gravel road, was awarded to Hutsell & Wolfeale, Markle, Ind., $17,997.

Laporte, Ind.—The contract for constructing 14,932 ft. of macadam road in Scipio township was awarded to Jake Ackerman, Laporte, Ind., $21,350.

Michigan City, Ind.—The contract for constructing a macadam road was awarded to Jacob Ackerman, Laporte, Ind., $21,350.

Muncie, Ind.—The contract for constructing 2 miles of brick roadway in Delaware county, was awarded to William Birch, Muncie, Ind., $42,000.

South Bend, Ind.—The contract for constructing pavements on first alley south of Division st. between Main and Michigan sts. with Barr clay brick, was awarded to Hoban & Roach, South Bend, Ind.

Vincennes, Ind.—The contract for constructing J. W. Williams road was awarded to William Bobe, Vincennes, Ind., $9,200.

Wabash, Ind.—The contract for constructing 2 macadam roads was awarded to Geo. M. Sewell, Laketon, Ind., $9,200.

Washington, Ind.—The contract for constructing 3 miles of road in Daviess county, was awarded to M. H. Wilson, Montgomery, Ind., $10,201.

Williamsport, Ind.—The contract for a gravel road construction, was awarded to W. W. Vrane, Hendrick, Ind., and to D. H. Fatout, Indianapolis, Ind.

Cedar Rapids, Ia.—The contract for constructing various asphalt roads was awarded to McCarthy Improvement Co., Davenport, Ia., $40,000.

Sioux City, Ia.—The contract for paving various streets was awarded to Flinn & Hanlon, Sioux City, Ia., $36,000.

Wichita, Kan.—The contract for paving with brick, portions of Water, 3rd, and 1st sts., was awarded to H. L. Miles, Wichita, Kan.; the contract for paving various streets with Hassam-Woodman, was awarded to Rackliffe-Gibson, Wichita, Kan.

Paducah, Ky.—The contract for constructing concrete sidewalks, granite curbing, etc., was awarded to Geo. W. Ketterjohn, Paducah, Ky., $6,775.

Baltimore, Md.—The contract for paving Patuxent st. with vitrified brick, was awarded to Martin T. Beach, Knickerbocker Bldg.

Crookston, Minn.—The contract for asphalt paving was awarded to General Contracting Co., Minneapolis, Minn.

Minneapolis, Minn.—The contract for furnishing 2,000 sq. yds. of creosoted wood blocks per day during the year 1911, was awarded to Republic Creosoting Co., Minneapolis, Minn., for $200,000.

Sedalia, Mo.—The contract for paving Prospect st. with brick block on 4 in. concrete base, cement filler, was awarded to Jas. W. & Geo. T. Menefee, Sedalia, Mo.

Springfield, Mo.—The following contracts were awarded: Paving as follows: Elm st. with brick, to J. C. Likes, Springfield, Mo., and with Hassam on Mt. Vernon and Commercial sts., to Rackliffe-Gibson Construction Co., Springfield, Mo..

Lincoln, Neb.—The contract for repaving district No. 41 was awarded to Abel & Roberts, Lincoln, Neb.

Salem, N. J.—The contract for grading, graveling and placing oyster shell surface on the Mannington, Pilegrove and Woodstown road was awarded to Tuft & Kelly, Salem, N. J., for $26,441.

Mt. Pleasant, N. Y.—The contract for improving Columbus and Commerce aves. was awarded to Molls & Murray, Yonkers, N. Y.

Wilmington, N. C.—The contract for paving 3,570 sq. yds. of street with gravel, was awarded to Bowe & Page, Charleston, S. C.

Cincinnati, O.—The contract for the improvement of Wilstach st. with granite, from Denman st. to McLean ave., was awarded to Kirchner & Co., Cincinnati, O., $16,255.

Circleville, O.—The contract for paving Court st. with vitrified brick, was awarded to Jas. L. Lynch, Flint, Mich.

Columbus, O.—The contract for resurfacing with tar the N. High st. road, was awarded to J. W. Jewett, Worthington, O., $13,000; the contract for constructing pavement on the Mound st. viaduct, was awarded to A. G. Pugh, Columbus, O., $18,000.

Hamilton, O.—The contract for paving East ave.. South B. st. and North 6th st., was awarded to Andrews Asphalt Paving Co., Hamilton, O.

Jefferson, O.—The contract for macadamizing a road in Saybrook township, was awarded to Buckeye Engineering Co., Norwalk, O.

Lakewood, O.—The contract for furnishing material and constructing brick paving on Gladys and Rosewood avenues, Thoreau road and Sloane avenue was awarded to W. S. Pace, 11027 Clifton boulevard, Cleveland, O.

Worthington, O.—The contract for resurfacing North High st. road was awarded to J. W. Jewett, Worthington, $13,000.

Bartlesville, Okla.—The contract for paving E. 3rd st., including curbing, guttering, grading and laying sewers, was awarded to Krauil & Co., Bartlesville, Okla.

Oklahoma City, Okla.—The contract for paving with sheet asphalt on 5-in. concrete base, a portion of Exchange ave., was awarded to Western Paving Co., Olkahoma City, Okla.

Altoona, Pa.—The contract for paving various streets was awarded to Bell, Deckel Co., Altoona, Pa., for $300,000.

Wlikesbarre, Pa.—The contract for grading and curbing Division st., was awarded to Warren Lumber, Syracuse, N. Y.

Dallas, Tex.—The contract for paving S. Harwood st. was awarded to Texas Bitulithic Co., Dallas, Tex., $64,192.

El Paso, Tex.—The contract for paving S. Santa Fe st. was awarded to Texas Bitulithic Co., El Paso, Tex.

Martindale, Tex.—The contract for constructing 3½ miles of gravel road was awarded to Van B. Flowers, Lockhart, Tex.

Wichita Falls, Tex.—The contract for constructing 36,000 sq. yds. of wood block street paving was awarded to Creosote Wood Block Paving Co., Gulfport, Miss.

Norfolk, Va.—The contract for macadamizing a new road was awarded to E. Parke Lindsay, Norfolk, Va., $16,103.

Aberdeen, Wash.—Improvement of Hume st. and others, to Aberdeen Construction Co., Aberdeen, Wash., $6,200.

Everett, Wash.—The contract for grading district No. 237 was awarded to Atlas Construction Co., Everett, Wash., for $22,974.

Puyallup, Wash.—The contract for paving Rainier st. and others, was awarded to Warren Construction Co., Portland, Ore., $24,448.

Tacoma, Wash.—The contract for grading S. 49th and 51st sts. between Sheridan ave. and east line of Acme addition, was awarded to N. A. Jones, California Bldg., $7,317; for paving the alley between S. K and L sts., was awarded to Anderson & Liljebeck, 4047 Spokane st., Tacoma, Wash., $4,185.

Kenosha, Wis.—The contract for paving Elizabeth st. was awarded to Chris. Peterson, Kenosha, Wis.

SEWERS.

CONTEMPLATED WORK.

Anaheim, Cal.—The construction of 18 miles of sewer is contemplated.

Lindsay, Cal.—The construction of a sewer system is contemplated.

Rockford, Ill.—Contemplating the construction of a combination storm and sanitary sewer, to cost about $152,000.

Nevada, Ia.—Contemplating the construction of a sewer system.

Hutchinson, Kan.—Contemplating the construction of a sewage disposal plant.

Grand Rapids, Mich.—The installation of a complete sewerage system is contemplated.

Hibbing, Minn.—Plans have been prepared for a sewer system. Estimated cost, $30,000.

Melrose, Minn.—Contemplating the construction of a sewer system in the spring.

St. Cloud, Minn.—Plans are being prepared for the construction of a sewer system.

St. Paul, Minn.—Contemplating the construction of a sewerage system in North st., Anthony Park, to cost about $130,000.

Terry, Mont.—Plans have been prepared for the installation of a sewer system.

Chadron, Neb.—Contemplating the construction of a sewer system.

Madison, Neb.—Plans are being prepared for the construction of a sewer system.

Binghamton, N. Y.—Plans have been completed for an intercepting sewer system and sewage disposal plant.

Dolgeville, N. Y.—Plans are being prepared for the extension of the sewerage system.

East Aurora, N. Y.—Plans have been prepared for the construction of a sewer system and disposal plant.

Oneida, N. Y.—Plans are being prepared for the construction of a sewage disposal plant.

Red Springs, N. C.—Voted bonds for water works and sewer systems.

Wilmington, N. C.—Plans have been

completed for the construction of a sewerage system to cost about $180,000.

Canton, O.—Plans have been prepared for a sewage disposal plant.

Cincinnati, O.—Plans have been prepared for a sewer in Montgomery road from Langdon ave. to the N. & W. R. R.

Cleveland, O.—During the present year $1,000,000 will be expended for intercepting sewer extensions, and $250,000 for the construction of new sewers.

Dayton, O.—Plans have been prepared for the construction of sanitary sewers in parts of districts No. 4 on 2nd st., from Miami to Erie canal.

Sandusky, O.—Contemplating the reconstruction of the sewerage system and an overhauling of the water filtration system.

Urbana, O.—Contemplating the construction of a sewer system.

Duncan, Okla.—Voted $38,000 bonds for the construction of a sewer system, and the erection and maintenance of a sewage disposal plant.

Gresham, Ore.—Contemplating the construction of water works and sewer system.

Bridgewater, Pa.—Contemplating the construction of a sewer system.

Connellsville, Pa.—Plans have been prepared for the construction of a sewage disposal paint, estimated cost, $150,000.

Grove City, Pa.—Construction of sewers to cost about $15,000 is contemplated.

Norristown, Pa.—Contemplating the construction of a sewage disposal plant.

Pecos, Tex.—Construction of a sewerage system to cost $25,000, is contemplated.

Antigo, Wis.—Plans are being prepared for construction of sewer and sewage disposal plant.

West Minster, B. C.—Plans are being prepared for the 8th st. sewer system, to consist of over 14 miles of vitrified sewer pipe.

Prince Rupert, B. C.—Contemplating the construction of a sewer system, to cost about $200,000.

Simcoe, Ont.—Plans are being prepared for a sewage disposal plant to cost about $60,000.

Toronto, Ont., Can.—Contemplating the construction of storm overflow sewers, to cost about $824,000.

CONTRACTS TO BE LET.

Mobile, Ala.—Bids will be received until Feb. 16 for constructing cement street paving, approximately 11,400 sq. yds., 8,400 lin. ft. curb, 1,000 lin. ft. of vitrified sewer piper, etc. Board of public works.

Riverside, Cal.—Bids are requested for steel and vitrified pipe and all working tools. Shull, Tucker & Co., 985 Walnut st., Riverside, Cal.

Atlanta, Ga.—Bids will be received until Feb. 6 for constructing all sewers that may be ordered during year of 1911; furnishing vitrified pipe, cement and castings needed in the construction of sewers, etc. City clerk.

Savannah, Ga.—Bids are requested for furnishing ditching machinery. Fred M. Clark, Savannah, Ga.

Yorkville, N. Y.—Bids will be received until Feb. 9, 4 p. m., for constructing a sewer system of the following approximate quantities: 19,000 lin. ft. of sewers, 8 to 15 in.; disposal plant; 33 manholes; and 10 flush tanks. Certified check $500. W. Armstrong, clk., Yorkville, N. Y.

Huntington, W. Va.—Bids will be received until Feb. 20, 1 p. m., for constructing sewers in Adams ave. from 13th to 15th sts. and from Adams ave. in 15th st. to alley between Washington and Virginia aves. Certified check $500. John Coon, com. of streets.

North Milwaukee, Wis.—Bids are requested for furnishing a trench excavator. Otto Sufeld & Co., North Milwaukee, Wis.

Port Hope, Ont., Can.—Bids are requested for furnishing cement, mixing and trenching machinery. W. G. Gibson, Port Hope, Ont., Can.

Toronto, Ont., Can.—Bids will be received until Feb. 7 for laying reinforced concrete overflow pipe for sewage tanks, etc. G. R. Geary, mayor.

CONTRACTS AWARDED.

Birmingham, Ala.—The contract for constructing the Northside sewers, including six sections, was awarded to J. W. Gurley Co., Mobile, Ala., $250,000.

Brawley, Cal.—The contract for constructing a sewer system, including a septic tank 24x200 ft., 28 ft. deep, capacity, 85,000 gals.; 200 ft. of 8 in.; 1,542 ft. of 10 in.; 8,250 ft. of 12 in.; 1,700 ft. of 14 in. vitrified pipe; 31 manholes; 3 catch basins, and wooden outfall conduit was awarded to California Ornamental Brick Co., Los Angeles, Cal., $13,201.

Monrovia, Cal.—The contract for constructing a new sewer system, which includes about 30 miles of sewers, was awarded to R. C. Lowell, Los Angeles, Cal., $85,744.

Oakland, Cal.—The contract for sewer extensions was awarded to Mervy & Elwell Co., Oakland, Cal.

Orange, Cal.—The contract for constructing an outfall sewer system was awarded to E. R. Werdin Co., 407 H. W. Hellman Bldg., Los Angeles, Cal., $10,000.

Oroville, Cal.—The contract for constructing sewer system, was awarded to Contra Costa Construction Co., Berkeley, Cal., $90,372.

San Francisco, Cal.—The contract for constructing Sunnyside sewer was awarded to Coast Improvement Co., San Francisco, Cal., $11,250.

Santa Paula, Cal.—The contract for constructing sewer systems was awarded to M. N. Miagenovitch, 332 Leroy st., Los Angeles, Cal., $28,983.

Jacksonville, Fla.—The contract for laying 1,100 ft. of 15 in. and 200 ft. of 12 in. reinforced concrete pipe, was awarded to Reinforced Concrete Culvert Pipe Co., Jacksonville, Fla.

Palatka, Fla.—The contract for furnishing 4,000 ft. of vitrified salt-glazed pipe from 18 to 24 in. in diameter, was awarded to Southern Sewer Pipe Co., Birmingham, Ala.

St. Petersburg, Fla.—The contract for constructing 4,000 lin. ft. of sanitary sewer was awarded to L. B. Cooper, St. Petersburg, Fla.

Dalton, Ga.—The contract for constructing sanitary sewer system. The work will include about 6 to 9 miles of pipe sewers from 8 to 15 in., and disposal plant complete, was awarded to Kaig & Puryeor, Dalton, Ga.

Shelbyville, Ind.—The contract for constructing a sanitary sewer system was awarded to Julius Keller, Indianapolis, Ind., $45,104.

Louisville, Ky.—The contract for constructing section C of Middlefork sewer, was awarded to Henry Bickel Co., Louisville, Ky., $30,000.

Boston, Mass.—The contract for constructing a concrete surface drain in Western ave., Brighton, was awarded to Antony Cefalo, 220 Devonshire st., $11,942.

Houghton, Mich.—The contract for constructing sewer system in the park ad-

dition, was awarded to Chester C. Davis, Houghton, Mich.

Kalamazoo, Mich.—The contract for installing the Fulford st. sewer was awarded to Johnson & Van Dyke, Kalamazoo, Mich.

Sandusky, Mich.—The contract for constructing water works, sewers and electric light plant, was awarded to National Construction Co., South Bend, Ind., $26,000.

Keewatin, Minn.—The contract for installing storm and sanitary sewers, was awarded to H. L. Bartlett Co., Virginia, Minn.

Marble, Minn.—The contract for sewer construction was awarded to H. L. Bartlett Co., Virginia, Minn., $40,000.

St. Joseph, Mo.—The contract for constructing various sewers, was awarded to E. F. Mignery, St. Joseph, Mo.

St. Louis, Mo.—The contract for constructing sewer in N. Harlan Joint sewer district was awarded to Herman Construction Co., 444 S. Theresa ave., $326,447; the contract for constructing a sewer in Dale ave. in district No. 1 was awarded to John B. Turner, St. Louis, Mo., $21,401.

David City, Neb.—The contract for furnishing sewer pipe was awarded to Abel & Roberts, Lincoln, Neb.

Akron, O.—The following contracts were awarded: Constructing 2nd ave. sewer, to E. McShaffrey & Son, Akron, O., $11,234; constructing Water st. sewer, to H. O. Toole, Akron, O., $3,191.

Portland, Ore.—The contract for the construction of Holgate sewer extension was awarded to Paquet, Giebisch & Joplin, Portland, Ore., $104,353.

Gaffney, S. C.—The contract for constructing two sewage disposal plants, was awarded to Porter & Boyd, Charlotte, N. C., $9,000.

Aberdeen, S. D.—The contract for sewer construction was awarded to Fraser & Danforth, Rochester, Minn.

Beeville, Tex.—The contract for constructing sewer system was awarded to Trueheart & Jackson, San Antonio, Tex.

Corpus Christi, Tex.—The contract for constructing city sewerage system, was awarded to F. H. Lancashire, Houston, Tex., $75,000.

Corsicana, Tex.—The contract for extending sewer system was awarded to Freehart & Jackson, San Antonio, Tex., $17,364.

Dallas, Tex.—The contract for the construction of sewers in South Dallas, from Fair Grounds to Trinity river, was awarded to J. C. Underwood, Dallas, Tex.

San Antonio, Tex.—The contract for installing the Starr st. school sewerage system, was awarded to E. W. Lengs & Co., San Antonio, Tex.

Wichita Falls, Tex.—The contract for constructing sewers in the business district was awarded to I. H. Roberts, Wichita Falls, Tex., $14,000.

Salt Lake City, Utah.—The contract for sewer construction was awarded to A. A. Clark, Judge Bldg., Salt Lake City, Utah.

Chehalis, Wash.—The contract for laying 10 miles of sanitary sewers was awarded to W. J. Murphy, 1214 N. Steel st., Tacoma, Wash., $51,258.

Buffalo, Wyo.—The contract for a sewer system was awarded to Peter O'Brien, Denver, Colo., $37,369.

Vancouver, B. C.—The contract for furnishing material and constructing the first part of the sewer system, including sewers in seven streets was awarded to McDonnell & Gzouski, Vancouver, B. C., $206,000.

WATER WORKS.

CONTEMPLATED WORK.

Bisbee, Ariz.—Contemplating the erection of a 518,000 gallon steel tank 62 in. in diameter by 23 ft. high.

Lordsburg, Cal.—Bids will soon be received for the construction of water works system.

Ocala, Fla.—Contemplating the installation of a new water works system.

Anna, Ill.—Contemplating the construction of a filtration plant.

Atlantic, Ia.—Plans are being prepared for a new pumping and electric light plant.

Boone, Ia.—Voted $180,000 bonds for extensions to water works.

Whittemore, Ia.—Voted $7,000 bonds for construction of water works system.

Woburn, Mass.—Contemplating improvements to the water system, to cost about $200,000.

Holland, Mich.—Plans are being prepared for a pumping station on Maple and 20th sts.

Eveleth, Minn.—Contemplating the purchase of a new pump and the laying of a 16 in. main from the city line to the pumping station at St. Mary's Lake.

Hopkins, Mo.—The construction of a municipal water works system is contemplated.

Helena, Mont.—Voted $650,000 bonds for installation of water works system.

Battle Creek, Neb.—Voted $10,000 to construct water works system.

Bridgeport, Neb.—Contemplating the construction of a water works system.

Lodgepole, Neb.—Voted $10,000 bonds for the construction of a municipal water plant.

Glenridge, N. J.—Contemplating the construction of a municipal water works.

Hillsboro, N. J.—The construction of an electric light plant and water works system is contemplated.

Hornell, N. Y.—Voted $100,000 bonds for water storage reservoir.

Red Springs, N. C.—Voted bonds for water works and sewer systems.

Grand View, O.—Voted to issue bonds

Beaver Falls, Pa.—The contract for for the installation of water works system. Estimated cost, $50,000.

Niles, O.—Plans are being prepared for a filtration plant.

Sandusky, O.—Contemplating the reconstruction of the sewerage system and an overhauling of the water filtration system.

Delaware, Okla.—Voted $25,000 bonds for water works system.

Duncan, Okla.—Voted $12,000 bonds for extending and developing water works system.

Hominy, Okla.—Voted $36,000 bonds for water and sewer systems.

Oklahoma City, Okla.—An election is called to vote on water bonds to the amount of $1,500,000.

Falls City, Ore.—Voted $25,000 for a water works plant.

Gresham, Ore.—Contemplating the construction of water works and sewer systems.

Tarentum, Pa.—Plans are being prepared for municipal water works to cost about $100,000.

Fort Worth, Tex.—Voted $1,500,000 bonds for water works improvements.

Georgetown, Tex.—Improvements to water works and electric light plant are contemplated.

Mayfield, Utah.—Contemplating the construction of water works.

Spokane, Wash.—Bids will soon be

asked for the construction of an auxiliary pumping station at Lincoln Heights reservoir.

New Lisbon, Wis.—Voted bonds for the construction of water works and electric light plant.

Brandon, Man., Can.—Voted $50,000 bonds for improvement and extension of the water works.

Harrison, Ont., Can.—Voted Jan. 2 in favor of municipal water works, probable cost $35,000.

CONTRACTS TO BE LET.

Rippy, Ia.—Bids will be received until Feb. 6, 8 p. m., for constructing water works system. J. A. Haberer, cy. clk.

Hanover, Kan.—Bids will be received until Feb. 6, for furnishing material and constructing a pumping station. Dugall Spence, cy. clk.

Townsend, Mont.—Bids are requested for constructing water supply system. E. H. Goodman, clk.

North Bend, Neb.—Bids will be asked until Feb. 17 for installation of an auxiliary pumping station, including wells, building, pipes, etc. Frank D. Howe, cy. clk.

South River, N. J.—Bids will be received until Feb. 13, 8 p. m., for constructing a suction well, 25 ft. in diameter and 33 ft. deep, of brick and concrete. Chas. Anderson, boro. clk.

Toledo, O.—Bids will be received until Feb. 14, for constructing the purification of water works plant. Bond for 15 per cent required. J. T. Cowell, dir. of pub. serv.

Troy, O.—Bids will be received until Feb. 4 for constructing water mains. A. E. Sinks, audt.

Scottdale, Pa.—Bids are requested for pipe and lead. J. I. Dick, Scottdale, Pa.

Sheridan, Wyo.—Bids will be received until March 6 for constructing water supply main connecting the city reservoir to the city line, including the furnishing of about 7,934 ft. of 1 in. and 760 ft. of 10 in. cast iron pipe, valves and special castings. Arnold Tschirgi, cy. engr.

Winnipeg, Man., Can.—Bids will be received until Feb. 6, 11 a. m., for the erecting two pumping plants, each of a capacity of 1,000,000 gallons per 24 hours. M. Peterson, secy. bd. of control, Winnipeg, Man., Can.

Perth, Australia.—Bids will be received until Feb. 26 for furnishing electric pumping machinery. Minister of public works.

CONTRACTS AWARDED.

Corona, Cal.—The contract for furnishing and laying 4 to 5 miles of 8, 10 and 12-in. reinforced concrete pipe, was awarded to Sanders & Hackett, Corona, Cal.

San Francisco, Cal.—The contract for constructing Twin Peaks reservoir was awarded to Healy-Tibbitts Construction Co., 268 Market st., San Francisco, Cal.

Washington, D. C.—The contract for supplying pumping machinery for naval dry docks at Bremerton, Brooklyn and Pearl Harbor was awarded to Alberger Pump Co., New York, N. Y.

Chipley, Fla.—The contract for constructing water works system was awarded to Moore & Gammon, Chipley, Fla., $20,000.

Pensacola, Fla.—The following contracts were awarded: furnishing 18,000 ft. of 6-in. cast iron water main extension, to American Cast Iron Pipe Co., Birmingham, Ala.; hydrants and lead, to Ahrens & Ott, New Orleans, La.; and for water gate valves, to Fairbanks & Co., New Orleans, La.

Chicago, Ill.—The contract for furnishing four 300 h. p. water tube boilers was awarded to Edgemoor Iron Co., Edgemoor, Del.

Mitchell, Ind.—The contract for constructing water works system was awarded to S. S. Royland, Mitchell, Ind.

Onago, Kan.—The contract for constructing water works system was awarded to W. W. Cook & Son, Junction City, Kan.

Mound City, Kan.—The contract for constructing water works system was awarded to J. S. Worley Co., Reliance Bldg., Kansas City, Mo.

Newton, Kan.—The contract for furnishing 2,500,000 gallon pumping engine, was awarded to Laidlaw-Dunn-Gordon Co., New York, N. Y.

Lawrence, Mass.—The contract for furnishing 300 ft. of 4-in. pipe, 5,000 ft. of 8-in. pipe, 1,000 ft. of 12-in. pipe, 1,300 ft. of 12-in. pipe, for $22.34 per net ton, was awarded to C. S. Miller & Sons, Utica, N. Y.

Lowell, Mass.—The contract for furnishing and installing a new pump for Centralville pumping station was awarded to Allis Chalmers Co., Milwaukee, Wis., $40,700.

Pittsfield, Mass.—The contract for constructing Farnham dam and reservoir; 10 acres clearing; 47 acres clearing and grubbing; 83,200 cu. yds. earth excavation; 9,600 cu. yds. rock excavation; 3,650 cu. yds. mass concrete; 3,900 cu. yds. cyclopean masonry; 3,900 cu. yds. concrete blocks; 4,000 lin. ft. furnishing and laying 12 to 24-in. vitrified pipe; 600 sq. yds. granolithic surfacing; 13,000 cu. yds. paving; 27,000 ft. B. M. furnishing and placing spruce lumber, and gate house superstructure, to Winston & Co., New York, N. Y., $399,600.

Sandusky, Mich.—The contract for constructing water works, sewers and electric light plant, was awarded National Construction Co., South Bend, Ind.

Brainerd, Minn.—The contract for the erection of a 50,000-gal. steel tank on concrete foundation, was awarded to Kennicott Co., St. Paul, Minn.

Warrenton, Mo.—The contract for constructing water works was awarded to Des Moines Bridge & Iron Co., Des Moines, Ia., $6,220.

Beatrice, Neb.—The contract for constructing water and lighting plants, was awarded to Mathews Construction Co., Kansas City, Mo.

Ft. Crook, Neb.—The contract for constructing reservoir and well was awarded to J. W. Turner Development Co., Des Moines, Ia., $18,500.

Stratton, Neb.—The contract for constructing water works system was awarded to Inter-Mountain Bridge & Construction Co., Tecumseh, Neb., $11,000.

Cimarron, N. M.—The contract for constructing water works was awarded to Cook & Gregory Construction Co., Joplin, Mo., $32,329.

Angola, N. Y.—The contract for constructing and installing water works plant was awarded to Mahoney & Swanson, Jamestown, N. Y., $55,000.

Geneva, N. Y.—The contract for furnishing iron pipe and specials was awarded to Charles Miller & Son, Utica, N. Y., $30,000.

Oriskany, N. Y.—The contract for the construction of a gravity system of water supply was awarded to John Siegrist, Utica, N. Y., $26,794.

Troy, N. Y.—The contract for furnishing 105 tons of cast iron water pipe

was awarded to Chas. Miller & Sons Co., Utica, N. Y.

Fayetteville, N. C.—The contract for constructing a filtration plant and two filter units of 500,000 gallons daily capacity, piping, machinery, etc., was awarded to Clarendon Construction Co., Wilmington, N. C., $12,858.

Cleveland, O.—The contract for installing engines at Kirtland Pumping station was awarded to Holly Engine Co., Buffalo, N. Y., $112,769.

Frewater, Ore.—The contract for constructing water works system was awarded to J. H. Jager, St. Louis, o. M

Jacksonville, Ore.—The contract for constructing new water works system was awarded to Jas. J. Mears, Portland, Ore., $50,000.

Klamath Falls, Ore.—The contract for the construction of Lost River division water works was awarded to W. H. Mason, Klamath Falls, Ore., $63,607.

Portland, Ore.—The contract for furnishing 5,972 tons of cast iron pipe ranging from 6 to 30 in. in diameter, was awarded to the United States Cast Iron Pipe & Foundry Co., Chicago, Ill., $178,-972.

Stillwater, Okla.—The contract for constructing water works was awarded to Southwestern Engineering Co., Oklahoma City, Okla., $40,000.

Yukon, Okla.—The contract for constructing water works and sewer system was awarded to N. R. Sherman & Co., Oklahoma City, Okla., $35,000.

constructing dam and reservoir was awarded to L. Adavasio & Co., Youngstown, O., $300,000.

Denison, Tex.—The contract for furnishing machinery for pumping station, was awarded to Briggs Weaver Machinery Co., Dallas, Tex., $11.740.

Fort Worth, Tex.—The contract for furnishing duplicate air compressor for city water works was awarded to Ingersoll Rand Co., St. Louis, Mo., $21,574.

San Antonio, Tex.—The contract for furnishing 1,500,000 lbs. of water mains, consisting of 6, 8, 10 and 12-in. piping,

Stamford, Tex.—The contract for constructing 300,500,000-gallon reservoir, was awarded to W. J. Cox, Stamford, Tex.

North Yakima, Wash.—The contract for constructing about 75 miles of laterals in connection with the Yakima irrigation project was awarded to Nelson Rich, Prosser, Wash., $50,160.

Tacoma, Wash.—The contract for laying water mains was awarded to Lister Construction Co., Berlin Bldg., Tacoma, Wash., $27,290.

Greybull, Wyo.—The contract for constructing water works system was awarded to Garrard Construction Co., Sheridan, Wyo., $31,960.

BRIDGES.

CONTEMPLATED WORK.

Fullerton, Cal.—The construction of a bridge, to cost $10,000, is contemplated.

Hanford, Cal.—The construction of a 600 ft. trestle over Tule river, near Corcoran, is contemplated.

Santa Ana, Cal.—Plans are being prepared for the construction of a highway bridge at Newport Bay.

Denver, Colo.—Contemplating the contemplating the construction of a bridge over Dry creek at 12th ave. and another over the same creek between 6th and 7th avenues.

Jacksonville, Fla.—Contemplating the construction of a reinforced concrete bridge across Hogan's creek at East Bay st.

Rome, Ga.—Contemplating the construction of 240 culverts and 60 steel bridges during tre next two years.

Burley, Ida.—Contemplating the construction of a bridge over Snake river.

Elgin, Ill.—Plans have been prepared for a concrete bridge at Willard ave.

Rockford, Ill.—Reinforced concrete bridge at Morgan st. is contemplated.

Indianapolis, Ind.—Plans are being prepared for a bridge over Fall creek, at Capitol ave. Estimated cost, $80,000.

Cedar Rapids, Ia.—The construction of a bridge on the site of present 3rd ave. structure is contemplated.

Kansas City, Mo.—Bids will be received soon for construction of concrete bridge across the Blue river at 15th st.

New Brunswick, N. J.—The construction of a 60 ft. lift bridge across Cheesquake creek is contemplated.

Fulton, N. Y.—Contemplating the construction of a concrete bridge at Broadway.

Whitehall, N. Y.—Construction of a bridge over South Bay, Lake Champlain, is contemplated.

Castle Hayes, N. C.—Contemplating the construction of a steel bridge across the Northeast river, to cost about $30,000.

Durham, N. C.—Contemplating the construction of a bridge over Eno river. Estimated cost, $12,000.

Williston, N. D.—Contemplating the construction of a bridge across the Missouri at this place.

Bolivar, O.—Plans are being prepared for the construction of a steel bridge 320 ft. long.

Cincinnati, O.—Contemplating the construction of a viaduct 1,400 ft. long at Spring Grove and Dodsworth aves.

Bannsford, Okla.—Contemplating the construction of a bridge over the Cimmaron river a mile north of the city.

Tulsa, Okla.—Bonds to the amount of $185,000 were sold, and the following improvements are contemplated: water works, $100,000; sewer extension, $35,000; incinerating plant, $25,000; viaduct, $25,-000.

Portland, Ore.—Plans have been completed for the new Ellsworth-Meade st. bridge. It will be 4,000 ft. long including approaches, will contain 11 spans, in the clear 60 ft. wide. Probable cost, $1,-000,000.

Pittsburg, Pa.—An ordinance has been passed providing for the construction of the Point Bridge, to cost $850,000.

Reading, Pa.—Plans have been prepared for a reinforced concrete bridge on concrete foundation at the foot of Penn st.

Scranton, Pa.—Contemplating the construction of a viaduct at Mulberry st. to cost about $250,000.

Wyoming, Pa.—The construction of a bridge over the Susquehanna river is contemplated.

Chattanooga, Tenn.—Voted $550,000 bonds for the construction of two bridges across the Tennessee river.

Houston, Tex.—Voted $500,000 bonds for the construction of a viaduct over Buffalo Bayou at foot of Main st.

Seattle, Wash.—The construction of a steel bridge at 12th ave. S. and Dearborn st., is contemplated.

Spokane, Wash.—Plans have been prepared and submitted to the city council for a concrete bridge across the Latah creek at Chestnut.

Zillah, Wash.—The construction of a bridge across the Yakima river is contemplated.

Grantsville, W. Va.—Contemplating the

construction of a bridge across the Little Kanawha river.

Edmonton, Alberta, Can.—Voted $167,000 for the construction of another steel bridge across the Saskatchewan river and $12,000 for a concrete subway.

CONTRACTS TO BE LET.

Ocilla, Ga.—Bids will be received until Feb. 6 for constructing a steel bridge over Alapaha river on Irwinsville and Tifton public roads. G. T. Young, cy. clk.

Columbus, Ind.—Bids will be received until Feb. 6 for constructing a bridge in Rock Creek township. P. J. Sater, audt.

Rushville, Ind.—Bids will be received until Feb. 7 for constructing macadam road in Ripley township. Jesse M. Stone, audt.

Chanute, Kan.—Bids will be received until Feb. 6, 12 m., for constructing bridge across Neosho river. W. F. Sams, cy. Clk.

Minneapolis, Minn.—Bids will be received until Feb. 4 for repairing bridge No. 4. A. F. Ericson, audt.

Salem, N. J.—Bids will be received until Feb. 8 for constructing a concrete floor bridge in the borough of Woodstown. Board of chosen freeholders, Salem, N. J.

Woodstown, N. J.—Bids will be received until Feb. 8 for constructing concrete floor bridge in the borough of Woodstown, N. J. Levi S. Prickett, Woodstown, N. J.

Zanesville, O.—Bids will be received until Feb. 6 for constructing the superstructure of the 5th st. bridge. H. A. Bernhaus, co. audt.

Yankton, S. D.—Bids will be received until Feb. 27, 7:30 p. m., for constructing a steel reinforced concrete bridge across the Rhine creek on Walnut st. John W. Summers, audt.

Bellingham, Wash.—Bids will be received until Feb. 10 for constructing the Palmers bridge. County commissioners, Bellingham, Wash.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for constructing a reinforced concrete girder bridge over the Arroyo Seco at the north end of Prospect Square, was awarded to Andrew Holloway, Pasadena, Cal., $15,000.

Pasadena, Cal.—The contract for constructing a reinforced concrete bridge and retaining walls, north of Prospect Square, was awarded to Andrew Holloway, 16 S. Raymond ave., Pasadena, Cal., $15,000.

San Diego, Cal.—The contract for the construction of five bridges on the new coast highway route from Oceanside to the Orange county line, was awarded to Knight & Hyde, San Diego, Cal., $24,603.

San Francisco, Cal.—The contract for constructing steel bridge over the cut at Harrison st., was awarded to Foster & Vogt, San Francisco, Cal., $31,997.

Cedartown, Ga.—The contract for constructing two steel bridges was awarded to J. W. Honseal, Cedartown, Ga.

Salmon, Ida.—The contract for constructing bridge across Lemhi river at Barracks Lake, was awarded to E. L. Emigh, Salmon, Ida.

East St. Louis, Ill.—The contract for constructing four steel highway bridges over the Cahokia creek was awarded to Joliet Bridge & Iron Co., Joliet, Ill.

Rock Island, Ill.—The contract for constructing bridges over Rock river was awarded to Clinton Bridge & Iron Works, Clinton, Ia., $15,400.

Edwardsport, Ind.—The contract for constructing the Edwardsport bridge was awarded to Vincennes Bridge Co., Vincennes, Ind., $15,548.

St. Paul, Ind.—The contract for constructing a bridge over Flat Rock river was awarded to Kelly Construction Co., St. Paul, Ind.

Corydon, Ia.—The contract for construction of all iron bridges in Wayne county during the year was awarded to Corydon Lumber Co., Corydon, Ia.

Denison, Ia.—The contract for constructing county bridges was awarded to Lana & Co., Harlan, Ia.

Des Moines, Ia.—The contract for constructing Milan bridge was awarded to Clinton Bridge Co., Clinton, Ia., $25,000.

Minneapolis, Minn.—The contract for constructing a steel bridge across the narrows at Lake Minnetonka was awarded to Minneapolis Steel & Machinery Co., Minneapolis, Minn, $38,500.

Red Jacket, Minn.—The contract for constructing concrete bridge was awarded to Marsh Engineering Co., Des Moines, Ia., $12,650.

David City, Neb.—The following contracts were awarded: Wood and steel bridges to be constructed in Butler county, to Nebraska Construction Co., Lincoln, Neb.; all cement culverts, to Wilson Reinforced Concrete Co., Nebraska City, Neb.; all metal culverts, to Nebraska Culvert Mfg. Co., Wahoo, Neb.

Hastings, Neb.—The contract for constructing all bridges during the year, was awarded to Standard Bridge Co., Omaha, Neb.

Omaha, Neb.—The contract for the construction of all bridges in York county, Neb., was awarded to Western Bridge & Construction Co., Omaha, Neb.

St. Paul, Neb.—The contract for constructing new bridges and repairing all old structures during the year was awarded to Nebraska Construction Co., Lincoln, Neb.

Rome, N. Y.—The contract for constructing bridge over Erie canal at South Washington st., was awarded to Henry Tosh & Son, Port Byron, N. Y., $14,777.

Durham, N. C.—The contract for constructing a bridge across Eno river of reinforced concrete, was awarded to Carter Construction Co., Burlington, N. C., $10,500.

Winston-Salem, N. C.—The contract for constructing a concrete bridge to span the Eno river at Christian's Mill, was awarded to Carter Construction Co., Winston-Salem, N. C., $10,500.

Cincinnati, O.—The contract for constructing Cooper ave. bridge was awarded to Gerald W. Knight, 3037 Woodburn ave., Cincinnati, O., $13,971.

Lockland, O.—The contract for constructing a concrete bridge on Cooper ave. was awarded to Gerald W. Knight, 3037 Woodburn ave., Cincinnati, O., $13,971.

Haskell, Okla.—The contract for constructing a bridge over the Arkansas river was awarded to Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $59,250.

Wagoner, Okla.—The contract for constructing a bridge across the Verdigris river at Mingo Ferry was awarded to Canton Bridge Co., Canton, O., $14,000.

Portland, Ore.—The contract for constructing the superstructure of the Broadway bridge was awarded to Union Bridge & Construction Co., New Nelson Bldg., Kansas City, Mo.

Ducktown, Tenn.—The contract for the construction of two steel bridges was awarded to Joliet Bridge Co., Memphis, Tenn.

Cuero, Tex.—The contract for con-

structing a bridge across Guadalupe river was awarded to Virginia Structural Co., Roanoke, Va., $25,000.

Dallas, Tex.—The contract for constructing the Wilmer, Hutchins and Mallay bridges across Trinity river was awarded to Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $41,780.

Aberdeen, Wash.—The contract for constructing a steel bridge was awarded to Caldwell Co., Savage-Scofield Bldg., Tacoma, Wash.

Seattle, Wash.—The costract for constructing concrete viaduct was awarded to Butler Construction Co., 395 Crary Bldg., Seattle, Wash.

STREET LIGHTING.

CONTEMPLATED WORK.

Modesto, Cal.—Contemplating the improvement of the street lighting system.

Brazil, Ind.—Installation of electric light plant is contemplated.

Columbia City, Ind.—The remodeling and enlarging the electric light plant and installing machinery and equipment for adding a day current service, is contemplated.

Adair, Ia.—Voted $10,000 bonds for the construction of an electric light plant.

Atlantic, Ia.—Plans are being prepared for a new pumping and electric light plant.

Fairfield, Ia.—Improvements to light and water systems are contemplated.

Crowley, La.—Contemplating the purchase of a 110 h. p. engine, 150 k. w. dynamo and a 75 k. w. dynamo and the installation of a two-unit system and 24 hour service of lights and power at electric plant.

Tower, Minn.—The installation of a municipal lighting plant is contempalted.

Utica, Neb.—Contemplating the construction of an electric light plant.

Gibbsboro, N. J.—Contemplating the construction of a municipal light plant.

Hillsboro, N. J.—The construction of an electric light plant and water works system is contemplated.

Mandan, N. D.—Contemplating the installation of a municipal electric light system.

Minot, N. D.—The installation of a municipal light plant is contemplated.

Arlington, Ore.—The installation of an electric light plant is contemplated.

Eugene, Ore.—Contemplating the conconstruction of an electric light plant.

Etna, Pa.—Contemplating the construction of an electric light plant.

Hastings, Pa.—Contemplating the constructioun of a municipal light plant.

St. Lawrence, S. D.—The installation of an electric light system is contemplated.

Ft. Worth, Tex.—Voted $40,000 bonds to extend lighting system.

Georgetown, Tex.—Improvements to the water works and electric light plant are contemplated.

Seattle, Wash.—The installation of cluster lights on Westlake avenue is contemplated.

New Lisbon, Wis.—Voted bonds for the construction of water works and electric light plant.

Waupaca, Wis.—The construction of a municipal lighting plant is contemplated.

CONTRACTS TO BE LET.

Atlantic, Ia.—Bids will be received until March 1 for constructing electric light and power plant. T. E. Nichols, clk.

CONTRACTS AWARDED.

Elmo, Colo.—The contract for lighting streets during the year was awarded to Pacific Gas and Electric Co., Elmo, Colo.

Belvidere, Ill.—The contract for lighting streets for ten years was awarded to Public Service Operating Co., Belvidere, Ill.

Bluffton, Ia.—The contracts for furnishing additional equipment for the municipal electric light plant were awarded as follows: 450 h.p. engine to the Harrisburg Foundry and Machine Co., Harrisburg, Pa.; generator and other electrical equipment, to Ft. Wayne Electric Works, Ft. Wayne, Ind. Total cost, $10,000.

Sandusky, Mich.—The contract for constructing water works, sewers and electric light plant was awarded to National Construction Co., South Bend, Ind., for $26,000.

Barnum, Minn.—The contract for lighting streets with electric lights was awarded to Cloquet Electric Co., Barnum, Minn.

Beatrice, Neb.—The contract for constructing water and lighting plants was awarded to Mathews Construction Co., Kansas City, Mo.

Portsmouth, N. H.—The contract for street lighting for five years was awarded to Buckingham County Light & Power Co., Portsmouth, N. H.

Rome, N. Y.—The contract for lighting the streets for five years was awarded to Rome Electric Light & Power Co., Rome, N. Y.

Cleveland, O.—The contract for furnishing arc lamps and electricity for street lighting was awarded to Cleveland Electric Illuminating Co., Cleveland, O.

Defiance, O.—The contract for lighting streets for ten years was awarded to Defiance Gas and Electric Co., Defiance, O.

Hoquiam, Wash.—The contract for five year lighting contract was awarded to Grays Harbor Gas Co., Hoquiam, Wash.

FIRE APPARATUS.

CONTEMPLATED WORK.

Long Beach, Cal.—Contemplating the purchase of a combination chemical wagon.

Bridgeport, Conn. — Contemplating the purchase of an auto engine.

Fairfield, Conn.—Contemplating the purchase of a fire engine.

Aurora, Ill.—Fire Chief Rang has recommended the installation of motor-driven vehicles in the fire department.

David, Ill.—The purchase of a chemical engine is contemplated.

East Moline, Ill.—The purchase of an auto truck is contemplated.

Ft. Wayne, Ind.—The mayor has recommended the purchase of an auto combination chemical hose wagon.

Terre Haute, Ind.—Chief Tully has recommended the purchase of an auto patrol wagon.

Davenport, Ia.—The purchase of an additional truck is contemplated.

Chelsea, Mass.—Contemplating the purchase of a rubber-tired combination hose wagon and two coal wagons, and may also equip No. 1 with rubber-tired wheels.

Fitchburg, Mass. — Contemplating the purchase of motor fire apparatus and 1,000 feet of fire hose.

Greenfield, Mass. — Contemplating the purchase of a chemical engine.

Methuen, Mass.—The purchase of auto truck is contemplated.

New Bedford, Mass.—The purchase of an auto combination chemical hose wagon is contemplated.

Springfield, Mass.—The purchase of two aerial trucks is contemplated.

Waltham, Mass.—The purchase of an auto chemical and an auto wagon has been recommended by the mayor.

West Springfield, Mass.—The purchase of an auto engine is contemplated.

Worcester, Mass.—The purchase of two double tank auto chemicals and 5,000 feet of hose is contemplated.

Jefferson City, Mo.—The purchase of 1,000 feet of hose is contemplated.

Kansas City, Mo.—Residents of Mount Washington suburb will purchase a chemical engine.

St. Louis, Mo.—Contemplating the purchase of motor fire engine and hose for the county.

Belleville, N. J.—Contemplating the purchase of an auto engine.

Montclair, N. J.—The purchase of an auto engine and the installation of fire alarm boxes is contemplated.

Nutley, N. J.—The purchase of an auto apparatus is contemplated.

Point Pleasant, N. J.—Contemplating the purchase of a new apparatus.

Albany, N. Y.—Contemplating the purchase of the following: Automobile for the fire chief and combination chemical and hose automobile for steamer No. 4.

Bath, N. Y.—Contemplating the purchase of hose, rubber coats, gloves, modern nozzles, etc.

Truxton, N. Y.—Contemplating the purchase of an engine.

Hood River, Ore.—The purchase of a fire equipment is contemplated.

New Castle, Pa.—Contemplating the purchase of a steamer, two auto combination engines and hose, equipped with two 14-foot ladders and two 35-gallon chemical tanks.

Red Lion, Pa.—The purchase of a chemical engine is contemplated.

West Chester, Pa.—The purchase of a combination chemical hose wagon is contemplated.

Cheney, Wash.—The purchase of a chemical engine is contemplated.

Hanford, Wash.—The purchase of a hose cart and two engines is contemplated.

Random, Wis.—Contemplating the purchase of hose, hose wagon and gasoline engine.

Vancouver, B. C.—Contemplating the purchase of a gasoline pumping engine, chief's auto, water towers, aerial ladders and fire boat.

CONTRACTS TO BE LET.

Washington, D. C.—Bids will be received until Feb. 15 for furnishing a gasoline motor-driven fire engine and hose wagon combined. Commissioners of District of Columbia.

Seattle, Wash.—Bids will be received until Feb. 10 for furnishing 2,000 feet of 3½ in. and 3,000 feet of 3 in. cotton, rubber-lined, double-jacket fire hose. Certified check of 5 per cent. C. B. Bagley.

CONTRACTS AWARDED.

Chico, Cal.—The contract for furnishing second size steam fire engine was awarded to American La France Co., Elmira, N. Y., $5,750.

Stratford, Conn.—The contract for furnishing fire engine was awarded to Locomobile Co., Bridgeport, Conn.

Mishawaka, Ind.—The contract for auto fire truck was awarded to American-La France Co., Elmira, N. Y.

Jersey City, N. J.—The following contracts were awarded: Combination engine and hose motor wagon, to Pope Motor Co., Hartford, Conn., $5,200; 720 ft. 2½ in. 4-ply cotton-jacketed, rubber-lined fire hose, to Eureka Fire Hose Co., New York, N. Y.

New York, N. Y.—The contract for furnishing and delivering two gasoline-propelled pumping engines was awarded to Webb Fire Apparatus Co., 50 W. Broadway, New York, N. Y., $16,500.

Rochester, N. Y.—The following contracts were awarded: Furnishing 5,000 ft. of 2½ in. hose for fire department, to Eureka Fire Hose Mfg. Co., New York, N. Y., $5,000; 750 ft. of 2½ in. hose for streets department, to Chamberlain Rubber Co., New York, N. Y.

Muskogee, Okla.—The following contracts were awarded: Furnishing fire hose, to Eureka Fire Hose Co., Dallas, Tex., and New York Belting and Packing Co., St. Louis, Mo., 250 ft. each; 500 ft. of bi-lateral hose, to Bi-Lateral Hose Co., Chicago, Ill.

Dallas, Tex.—The following contracts were awarded: Furnishing 2,000 ft. of fire hose, to Eureka Fire Hose Co., New York City 500 ft. of Bay State Jacket brand, to Boston Woven Hose and Rubber Co., Boston, Mass.; 500 ft. of Goodrich brand, to Chicago Fire Hose Co., Chicago, Ill.

Ft. Worth, Tex.—The contract to furnish auto fire engine was awarded to Webb Fire Motor Co., Dallas, Tex.

Seattle, Wash.—The contract for furnishing three auto-propelled hose wagons was awarded to Pacific Coast Fire Supply Co., Seattle, Wash.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Napa, Cal.—The city council is considering the construction of a garbage crematory.

Sacramento, Cal.—The purchase of another furnace for the incinerating plant is contemplated.

Boston, Mass.—The installation of an incinerator in North Cambridge is contemplated.

Batavia, N. Y.—Plans for a garbage incinerator plant have been completed and were presented to the board of aldermen on Jan. 11.

Lestershire, N. Y.—Contemplating the construction of a garbage disposal plant.

Akron, O.—Contemplating the construction of a sewage and garbage disposal plant at the junction of the Big and Little Cuyahoga rivers.

Oklahoma City, Okla.—Contemplating the construction of a garbage incinerator.

Tulsa, Okla.—Bonds to the amount of $25,000 were sold to provide funds for an incinerating plant.

Winnipeg, Man., Can.—A garbage destructor with a daily capacity of 100 tons is contemplated.

CONTRACTS AWARDED.

Atlanta, Ga.—Collecting and disposing of city garbage, etc., for a period of 5 years at $153,852 for a year, with a bonus of $10,000 per year for each year. John C. West, 110 Irwin st., Atlanta, Ga.

Cumberland, Md.—The contract for street cleaning was awarded to Frederick Perry, Cumberland, $9,950, and garbage removal was awarded to A. L. Elosser, Cumberland, Md., $6,500.

Philadelphia, Pa.—The contract for the removal of garbage for this year was awarded to Penn Reduction Co., Philadelphia, Pa., $510,000.